APR 14 1924

Founded March 1, 1874—Fifty Years of Service

Electrical World

McGraw-Hill Company, Inc. *April 12, 1924* Twenty-five Cents Per Copy

WARD LEONARD RIBOHM

RIBOHM RHEOSTATS

FOR BATTERY CHARGING

THE largest single electric vehicle charging installation of its kind—that of Macy's Department Store, New York City, consists of 144 charging panels made up with Ward Leonard Ribohm Resistances instead of cast iron grids.

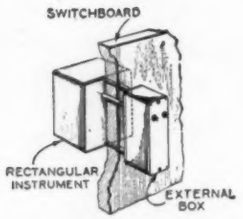
Ribohm Resistance Units consist of rolled and cold pressed special alloy ribbon:

They are rigid and self-supporting [even at red heat]
They are practically unbreakable
They are exceedingly light
They occupy less space than an equal capacity in any other form of rheostat
They have great heat radiating capacity.

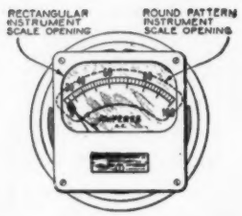
NOTE: 200 Ribohm sets are now being installed by the New York Edison Co. in their new battery charging station, —*the largest in the world.*

Back-of-board view showing Ribohm Resistors. This is a Westinghouse-Sarvas installation.

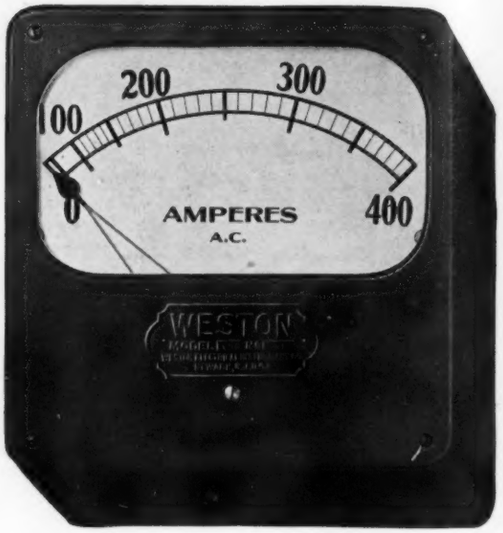
Ward Leonard Electric Company
Mount Vernon, New York

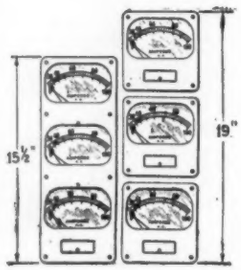


Layout of Rear—External boxes, where required, occupy less space than the instruments. The boxes are compact and are designed to be mounted on instrument mounting bolts.

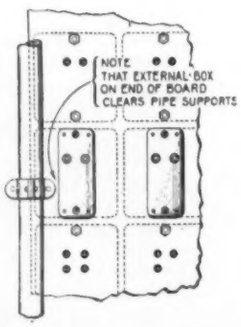


Same Scale Length—The Length of scale is equal for both the round pattern, 7½ in. diameter instrument and these new rectangular types. This is in spite of the reduced overall width and height of the new rectangular case.





Triplex Ammeter. The triplex ammeter allows an even greater saving than the single dial instruments. It saves 3½ inches in height over the three instruments it replaces.



Studs—All studs are arranged approximately on the approximate center axis of the instruments to clear pipe supports. This is especially important with instruments located at ends of switchboard.

Eight Good Reasons for the New Weston Rectangular Instruments

SMALLER SWITCHBOARDS—Weston Rectangular instruments permits the use of smaller boards for the same number of instruments.

ROOM FOR OTHER APPARATUS—Even with smaller switchboards, Weston rectangular instruments save so much space that there is room for more control apparatus than with the round pattern type.

EASY READING—Wide scale openings provide unusual legibility with freedom from shadows. It should be noted that the scale lengths of the rectangular instruments are equal to those of the 7¾ in. round type.

STANDARDIZED MOUNTING—Instruments and external boxes where required are quickly mounted by the same supporting bolts, giving a clean, compact arrangement on both sides of the board.

CASE DESIGN—For ease of inspection and convenience in making adjustments, the case is arranged to be quickly removed without dismounting the instrument. All cases are dustproof.

ACCURACY—Accuracy within one per cent of full scale value is guaranteed under all ordinary conditions of service. This accuracy should be maintained for a lifetime if the instrument is used with reasonable care.

RESPONSIVENESS—The movable system is extremely dead beat and exceptionally responsive to small and rapid changes in circuit conditions. This is a feature of utmost importance, especially on circuits subject to frequent and violent fluctuations.

INTERCHANGEABLE PARTS—Absolute interchangeability of parts makes repair work, when necessary, a simple matter.

Bulletin 1504 will interest every engineer and switchboard designer. Write for this bulletin to-day.

Weston Electrical Instrument Co.,
13 Weston Ave., Newark, N. J.
Branches in Principal Cities Throughout the World

Electrical Indicating Instrument Authorities Since 1888

WESTON

STANDARD - The World Over

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

Volume 83 New York, Saturday, April 12, 1924 *Number* 15

Another Kind of Customer Ownership

WHEN a man buys a share of preferred stock in his local electric light and power company there is no doubt that he has a sense of his interest in that company as a part owner. His deed is done deliberately and consciously. When, on the other hand, he buys an insurance policy or deposits his money in a savings bank he is no less directly interested in the light and power industry—but he doesn't know it!

Because of the very large interest of insurance companies in the securities—largely bonds—of the electric light and power companies, Haley Fiske, president of the Metropolitan Life Insurance Company, is trying to tell his policy holders of their consequent direct interest as individuals in the industry. Sent to some six million active policy holders of the Metropolitan company, his message pointing out that a substantial part of the $1,500,000,000 assets of the company is invested in light and power company bonds should have a sobering influence on their attitude toward the industry on whose success those bonds depend.

"Your life insurance company does not speculate," he points out. This constitutes at once a tribute to the soundness of light and power securities and a challenge to the light and power companies to maintain the record of stability. Mr. Fiske has rendered a service to his policy holders and to the electrical industry alike, and it should not go unappreciated.

The Professional Engineer Upheld as Administrator of Engineering Enterprise

WHEN Secretary Work replaced Arthur Powell Davis, an experienced and able engineer, by David W. Davis, a man reputed to be a good administrator but with no technical training or experience, as head of the Reclamation Service, engineers everywhere were immediately aroused. This action caused one of the most emphatic and sustained protests ever made by engineers as such in a matter where their profession was directly interested. Engineering societies have taken continued and persistent steps to compel the righting of the wrong—not on the personal basis of seeking the reappointment of Arthur Davis, but on the principle of appointing a capable engineer to this engineering position.

By directing the appointment of Elwood Mead to replace David W. Davis President Coolidge has corrected Secretary Work's error, has rendered the nation a distinct service and has given a gratifying recognition of the correctness of the principles urged by the engineering profession. Reclamation is distinctly an engineering enterprise and the Reclamation Service should be administered by an able engineer. Elwood Mead is known to be one of the most able, if not the most able, reclamation engineer in the country. His administrative ability is no less strongly attested.

Most important, however, is the fact that this action affirms the principle that professional enterprises in the government service should be administered by the most capable representatives of the professions concerned. There was some anxiety lest politics should undermine good administration. This act on the part of the President should do much to allay such fears as regards not only his own but subsequent administrations. That the issue should be raised over an engineering department makes it the more significant to engineers.

Sound Views of Federal Power Commission on the Colorado River Problem

PROPER development of the Colorado River has become a subject of nation-wide interest. There are questions of power supply, of protection against disastrous floods, of intelligent reclamation on a larger scale, all complicated by interstate and international claims and interests. It is therefore doubly important that whatever plan is adopted be based on sound principles and on intelligent analysis and investigation.

The Swing-Johnson bill has for some weeks been before the House committee on irrigation of arid lands. A lot of testimony relevant and irrelevant has been adduced. In striking contrast with extravagant claims and visionary predictions are the letter of the three Secretaries who compose the Federal Power Commission, the report of their engineer, Col. William Kelly, and the testimony of these four before the committee. What at once appeals to the engineering mind and to the judgment of all thinking men is that the approach to the problem made by the engineer is on a basis of sound engineering principles and that the approach by the three Secretaries rests on the established policy of the government in water-power development, the result of years of study. As the ELECTRICAL WORLD has often said, the development on any river of the water power alone is a problem of securing effectiveness in the development of the river as a whole—not merely the decision to build one dam; in fact, the decision to build one particular dam without thorough investigation of the whole may hamper future development. And when the problem is complicated by important questions of flood control and irrigation it is even more important that a complete study of the entire river and its tributary basin be made before any partial development is undertaken. This is the stand taken by Colonel Kelly with reference to the immediate plan to build a 600-foot dam at Boulder Canyon. He has also contributed a most constructive discussion of the immediate and later prospect of marketing the electric power.

The three Secretaries have taken a definite stand in support of applying the federal water-power act to this as to any other power development, and they have reiterated the arguments which in part at least lay back of the original adoption of that act. It is doubtful if many would go so far as to say with them that no

more private capital would go into public utility development once the government started in the business at Boulder Canyon. But most close students of government and of the history of water-power development will assuredly agree with the soundness of the general position they take. Government does not want to go into business. It does and should wish to regulate the development of the nation's resources and retain their ultimate control. All this is provided in the federal water-power act, to which the Swing-Johnson bill would create an exception, thus serving to weaken its usefulness and effectiveness.

There is little ground for doubt that the American people, through their Congress, will decide correctly on the proper development of the Colorado River. All that is needed is fair and professional presentation of facts. In this regard the Secretaries and their engineer have rendered commendable service.

The Spread of Practical Idealism

"BUSINESS men in their clubs, the Pullman smoker and wherever you meet them are a cleaner-talking, better-thinking group than their predecessors of a quarter of a century ago." This remark was made by the public relations man of a public utility who has had ample opportunity to observe. He attributed the improvement in part to the activities of such organizations as the Rotary and Kiwanis clubs, where, it is claimed, more than a quarter of a million men meet weekly around noonday lunch tables to discuss business ideals and methods of incorporating them in actual practice. Such weekly luncheon discussions as these organizations sponsor must inevitably leave an indelible mark on the business community. Whether it is wanted or not, idealism creeps into the business dealings of these men and a cleaner business world results.

The idealism behind these club activities is the idealism on which the real public relations programs are built. Its foundation is the spirit of honesty, friendliness, helpfulness and an appreciation of the viewpoint of the other man. Human nature never fails to respond to an appeal based on these four things.

Practical Co-operation Between Central Station and Electrical Dealers

THE plan recently proposed by the Public Service Company of Colorado whereby its customers may pay their bills at the various electrical dealers' stores throughout the city of Denver is a constructive step toward better service to customers, and it should pave the way to closer relations between the company and the electrical fraternity. By thus creating a number of new agencies, which in effect are branch offices, the company provides a convenience for its customers which will be greatly appreciated, especially by those who reside in outlying sections and would otherwise have to make a special trip to pay their bills at the company's downtown office.

In addition, this arrangement offers a very practical answer to the objection sometimes raised by contractor-dealers that the central-station company has cornered the appliance business by requiring customers to pass through a display of electrical devices each month to pay their bills at the cashier's window. If the contractor-dealer will capitalize on this opportunity to make new friends and consider every one who comes in to pay a bill in the light of a potential buyer of something electrical, he should realize a considerable increase in "over-the-counter" sales and also develop excellent prospects for sales of the higher-priced appliances. A number of central-station companies have adopted similar plans, which are working out to the mutual satisfaction and profit of the company and the dealers.

Improvements Needed in High Continuous Potentials

GREAT improvements and extensions have been accomplished in recent years in the available methods for obtaining high values of continuous voltage. Chief among them may be mentioned the rectifying vacuum tube with auxiliary capacity and inductance and the standard continuous-current generators with specially designed compensation permitting voltages up to 15,000 in a single armature. These methods have proved of great value in the testing of dielectric strength of cable insulation, in the operation of Roentgen ray tubes and in various problems of experiment and test. In the last-named field, however, it has come to be realized that in certain cases the methods mentioned have serious limitations on the ground of constancy and uniformity. If any appreciable current is taken in the vacuum-tube method, serious voltage pulsation is avoided only by large addition to the auxiliary capacity. Every generator has a commutator ripple in its voltage, and under-current is subject to irregularities due to brush contact. This type of disturbance is present in both the methods.

In many instances these types of variation are not objectionable, but they may cause great difficulty in investigations of precision, in which it is necessary to measure very low values of current at high voltage. As an instance may be mentioned the growing attention now being given to the study of the properties of high-voltage insulation. It is increasingly evident that dielectric absorption or viscosity has an important bearing on the life of insulation and, moreover, that little or no scientific study has been given to possible methods of controlling it. Its exact nature is not understood, but it varies widely in different types of insulation and certain more or less obvious methods of reducing it are well known, such as by drying out and the introduction of mica; hence there is good promise that greater knowledge will come from closer study.

Much study of this character has been given to single materials in comparatively thin layers and at low values of voltage gradient. It is important, however, that absorption be studied at gradients within the range at which the insulation will be operated. Alternating-voltage methods alone will not do, for they do not separate the absorption losses from those of other types. The absorption can be isolated only by the use of continuous voltage. Measurements must be made of very small values of continuous currents in specimens of high values of capacity and hence extremely sensitive to voltage variation. So far the high-potential battery is the only satisfactory source for these refined studies. The expense and inconvenience of the battery, however, give emphasis to the need of further improvements in the sources of high continuous potential.

Alternating Current or Direct Current for Metropolitan Service

A DIFFERENCE of opinion and practice exists among various groups of engineers in heavily loaded metropolitan districts as to the relative present and future merits of direct-current and alternating-current service. A correct decision is essential not only because it affects local investments of great magnitude, but also, on account of the frequency question involved, as an element in the development of extensive interconnected systems.

There are three elements in the problem which must be evaluated in the light of both present and future developments. These are relative investment and operating costs, relative reliability for giving adequate and continuous service and relative availability for utilization in the many ways required in heavily loaded city areas. It is a tremendous task to weigh all these factors, and it may be that the particular requirements of a local situation will have the most decisive influence upon any decision made solely on generalities. For example, a major consideration in downtown New York is the requirement for high-speed elevator service in the many high buildings. This necessity has so far been met best by direct-current service and equipment.

But the industry would benefit materially if the studies made by the various groups of engineers were made available and compared in open forum. Errors would be sought in the analyses, and a better perspective and more thorough knowledge would result. It is essential that correct answers be obtained to these debated questions, for they influence very materially the present attack on the whole question of generation, transmission and distribution in metropolitan areas.

Comfortable Lighting Is the Kind Which Makes Itself Desired

EVERY one who has studied lighting deeply and intimately knows that glare is a curse of which the influence extends far beyond the victim's eyes. The commercial manager may think that this is a matter for scientists, industrial uplifters and lighting experts. But it is very important to those whose business it is to increase the revenue of the central station and, in fact, to those interested in merchandising fixtures, lamps and anything pertinent to lighting. It is as true of lighting as of any other commodity that sales resistance is greatly reduced the moment that an article is appreciated and desired.

As one goes through homes, offices and factories and sees on every hand unshaded, glaring light sources, the conclusion is forced that most consumers are at least indifferent to lighting. In discussing artificial light with them it is found that many of them think of it as a sort of necessary evil which they must endure to extend activities beyond the boundaries of daylight. This attitude is not surprising when we note the conditions of improper lighting under which it has evolved. With unshaded light sources glaring here and there no one can see to the best advantage. Visual discomfort is apparent. The surroundings are harsh and unpleasant. Shade the light sources and diffuse the light and a magical change takes place.

The user of light is not likely to analyze these bad and good conditions, but just as he developed an attitude of indifference and even of antipathy toward artificial light under the bad conditions, so will he, doubtless unconsciously, lose his prejudice. If he begins to feel that artificial light is desirable or if he even becomes enthusiastic over it, so much the better. No one can deny that by replacing indifference by interest or antagonism by enthusiasm lighting sales will increase. By driving out glare a long step in this direction is taken, and therefore the commercial manager should be just as interested as the lighting expert. Lighting must be a thing of comfort before it can be desired.

Greater Standardization Needed in Steel Transmission Towers

DESIGNERS of steel transmission towers can build structures that will hold up under any conditions of line loading provided costs are forgotten. But most steel-line structures are now purchased on a price basis, and for this reason structures incorporate many different shapes and principles of design in order to reduce the weight of steel used.

Naturally, the manufacturers of steel structures are forced to use all their ingenuity in design to distribute the steel so as to get the minimum weight and maximum strength consistent with conformity to the specifications of the purchaser. In other words, the steel-tower business is highly competitive and labors under economic burdens which oppose standardization in design or publicity for design formulas. Under these conditions it follows that towers are apt to fail if the specified loadings are exceeded, and in addition a multitude of tower designs and types are available to the industry. Four-angle lattice and expanded I-beam poles, square-windmill type, A-frame type and H-frame type towers of many varieties and designs are available for service and are advertised as solving the structural problems of line designers.

Improvement in this situation can be brought about by co-operation between tower makers and tower users, and the first step would lie in the direction of obtaining a proper balance between cost and strength considering all elements and fixing very definite specifications for a minimum number of service applications. Loading of lines can be more definitely determined on a maximum-strength basis and the types of load can be more definitely stated. Vertical and dead loads, loads at angles to the line, unbalanced loads resulting from broken wires and the effect of maximum values of ice and wind in combination with the loads mentioned must be stated in tower specifications very definitely; and in addition the allowable factors of safety to be used in the design should be more nearly standardized and specified.

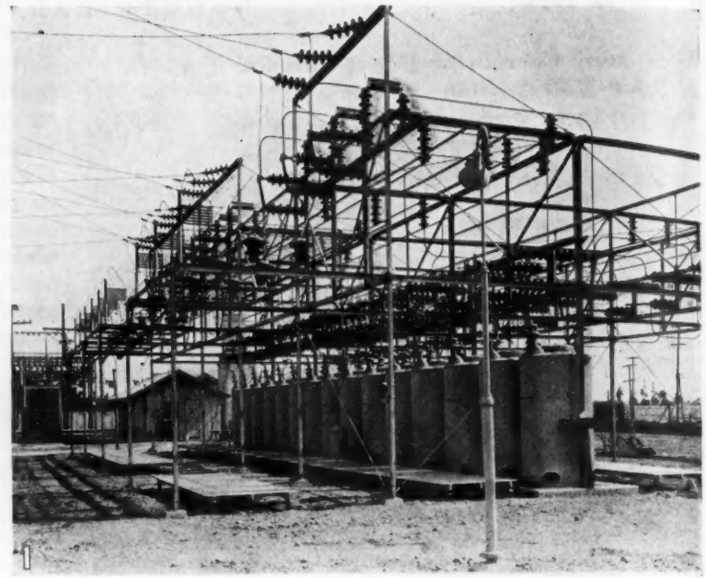
With these elements definitely fixed, competition would still be keen, for much leeway would be left to tower makers for advocating towers of different heights and shapes or incorporating patented or unusual structural features. Methods of construction and assembly are other features which would make for competition.

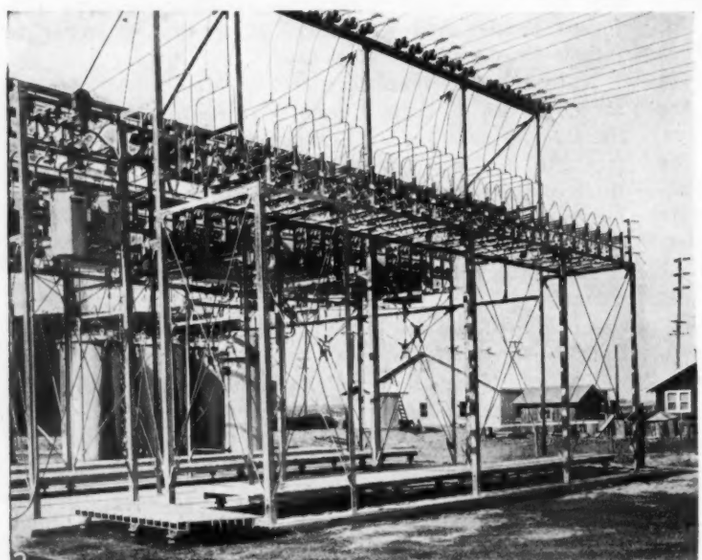
Thus more definitely fixing loads and factors of safety in tower specifications and a more analytical study of service conditions should go far toward bringing about greater standardization in tower designs and toward giving purchasers of towers a knowledge of design methods and constants whereby they would cease purchasing on a purely price basis and use the structures intelligently when installed.

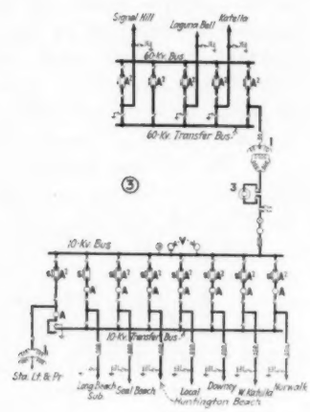
Two California Substations Using Graded-Resistor Lightning Arresters

THE Southern California Edison Company has installed two outdoor substations at Los Alamitos and Saticoy in which graded-resistor lightning arresters are used exclusively on the 60-kv. incoming and 11-kv. outgoing circuits. Three 60-kv. and seven 11-kv. lines are shown entering the Los Alamitos substation in illustrations 1, 2 and 3 respectively. Four 60-kv. and an equal number of 15-kv. lines enter the Saticoy substation, as shown in illustrations 4, 5 and 6 respectively.

S & C type H form 3A arresters are used in all cases, those for the higher-voltage circuits being rated at 73 kv. and those for the lower voltage at 15 kv. Eventually twenty-four 73-kv. and thirty-three 15-kv. arresters will be installed, their total cost being less than $6,000. Aside from their low cost, they were selected because they have no moving parts, are self-contained, need very little attention and no protection from the weather, are simple in construction and can be mounted overhead.

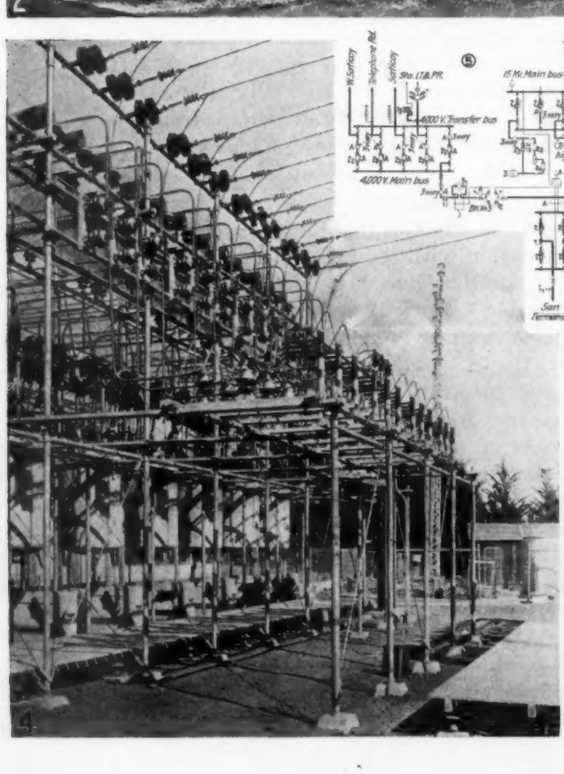

1

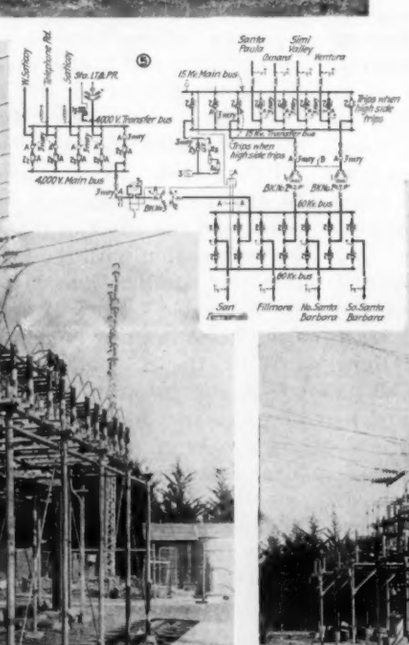

2



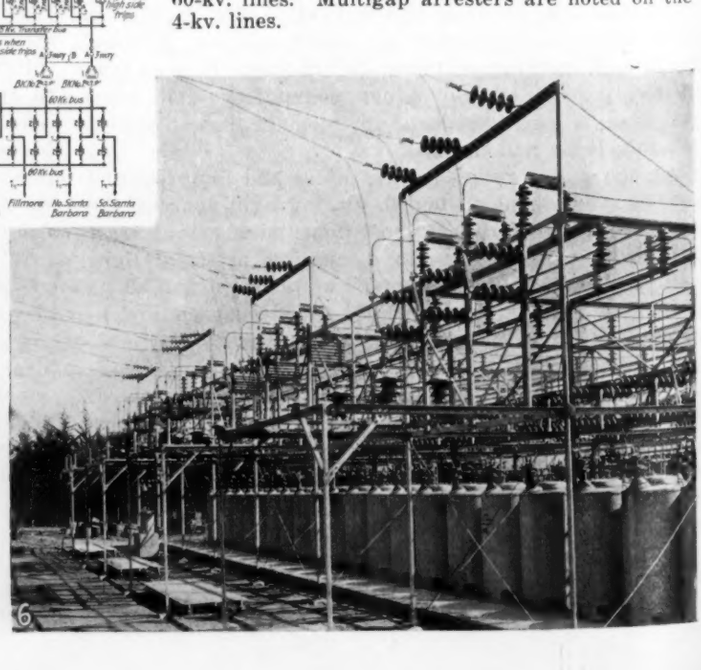
3

In Fig. 3 is shown a one-line diagram of the Los Alamitos substation and in Fig. 5 is shown a one-line diagram of the Saticoy substation. The graded resistance arresters may be noted on each of the incoming and outgoing 11-kv., 15-kv. and 60-kv. lines. Multigap arresters are noted on the 4-kv. lines.


4



5


6

Detecting Defective Insulators

Advantages of an Instrument Called the Aislometer Which Is Used on Live Lines for Locating Bad Units—Results of Tests and Operating Experiences —Description of the Device Used

By C. E. BENNETT
Acting Chief Engineer Riegos y Fuerza del Ebro, S A., Bareclona, Spain

ONCE a high-tension line has been properly built and placed in service the degree of success that is attained in its operation is very largely determined by the operating man's ability to locate and remove defective units in the line insulation before they make trouble. As defects nearly always occur one at a time and as lines are constructed with a large factor of safety, line failures will very seldom occur if the defective insulator units are located and changed within a reasonable time after the first fault has developed. With insulators of recent manufacture one test per year or even one test in every two years may be sufficient, but with older and more poorly designed insulators in strain service a test may be necessary as often as every three or four months. By making the tests as often as necessary and making them a part of the regular operating routine it is possible to remove the electrical hazard almost completely.

Although some operating companies have enough lines to make it possible to remove one from service for testing insulators, most companies are not so fortunate, and for these a safe and rapid method of testing by unskilled men whenever desired, without disturbing the operation of the line, is an absolute necessity. For all transmission systems such a method is very convenient and economical.

The simplest way to detect faulty insulator units is by utilizing the line voltage itself as an energy source because a unit in which a defect has developed does not carry the proper share of the total voltage, and it seems more logical to apply a properly insulated instrument directly to the insulator for making necessary measurements and finding out the disk performance under actual operating conditions than to deduce this performance from measurements made with more or less delicate and complicated apparatus at low voltage with the line out of service.

The testing of insulators is for the purpose of weeding out one or the other of two defective classes—those in which the insulating value is actually below normal at the time of test and those having defects, either of material or other design, capable of causing failure at some future time.

NEW INSTRUMENT CALLED THE AISLOMETER

An instrument has been developed for live-line insulator testing which has given very good results when applied to lines in Europe. It is simply a light, portable electrostatic indicator mounted on an insulating stick in such a way that its two terminals may be applied to the hardware (or cement) of an insulator (or shell), utilizing the part of the line voltage existing across the insulator to give an indication of its condition. As this constitutes a test at from 4,000 volts to 25,000 volts per disk (in the case of strain and suspension insulators) and determines the performance of the insulators under actual working conditions, it is independent of ordinary atmospheric conditions and disturbing influences that may invalidate other tests. This is especially the case in testing Hewlett-type insulators, which usually appear good when tested with a megger, although they may be punctured. The instrument operates something like an electrostatic voltmeter, but utilizes a special construction which makes its indication adjustable as regards the voltage to ground as well as for the voltage between terminals, thus allowing it to be calibrated according to the voltage that exists on the different units of an insulator string.

The necessity of a voltage adjustment and the impossibility of using an instrument operating as a simple voltmeter will be readily appreciated when it is considered that the voltage of a strain insulator near the line may be four or more times that of a unit near the ground end in the same string. Hence an insulator near the line may be so defective as to carry only a fraction of its normal voltage but still have as large a voltage difference across it as a good insulator near the ground. As the voltage on each unit of a string of insulators is fixed by the number and design of the disks and by the line voltage, there is a direct correspondence between the voltage per disk and the voltage to ground. The aislometer is therefore calibrated so that the voltage necessary to produce deflection varies with the voltage to ground according to the characteristics of the insulator string to be tested. By this means the condition of the insulator is shown by a direct indication, leaving nothing to the skill or judgment of the tester, for its calibration is made such that the unit is shown as "good" if it sustains approximately its normal voltage (whatever its position in the string and consequently whatever its normal voltage may be) and as "defective" if the voltage is well below normal.

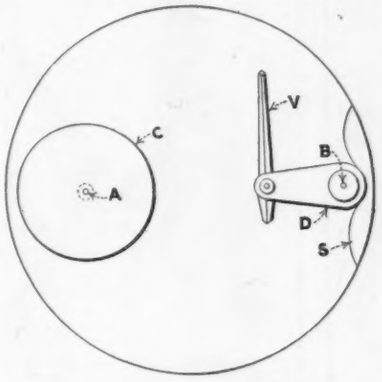


FIG. 1—SCHEMATIC DIAGRAM OF AISLOMETER

As ordinarily constructed, the instrument consists of a round tube, 4 in. (10 cm.) in diameter, fitted with a transparent unbreakable cover and mounted on an insulating base which carries two high-tension bushings. These bushings are fitted at the outer end with flexible coil springs spaced 7 in. (18 cm.) apart for making contact with the metallic parts of the insulator.

Within the tube one of the bushings is simply a thick closed tube of insulating material covering its electrode entirely so as to give the instrument a high insulating value, something in excess of 80,000 volts. The other

bushing ends at the inner surface of the insulating base, while the conductor which passes through it is prolonged and carries a light metallic vane which is pivoted so as to turn freely about an axis which is roughly parallel to the bushing. This vane, which is a little less than 2 in. (5 cm.) in length, is made of aluminum foil in the form of an "I" in cross-section so as to insure a large surface and considerable rigidity without appreciable weight or danger of warping. It is perfectly balanced so as to be unaffected by the inclination of the instrument and is arranged with a spiral spring and pivot mounting of the sort used in ordinary portable instruments. The calibration is such that the vane swings 90 deg. from its zero position for good insulators and remains stationary on the totally defective ones.

For convenience in applying the aislometer to the insulator string, whatever the position of the insulator relative to the man on the tower, the instrument is arranged with a trunnion mounting and arrangement for clamping it at any angle and is carried in a fork mounted at the end of an ordinary insulating stick such as those used for operating disconnecting switches. Whatever the angle of the instrument, it remains practically balanced about the axis of the stick, a convenience appreciated by the men who actually use it on the towers and poles. The instrument weighs 1.75 lb. (800 grams) alone or 2.3 lb. (1,050 grams) complete with the fork support but without the insulating stick. This weight can be easily manipulated even at the end of a long pole.

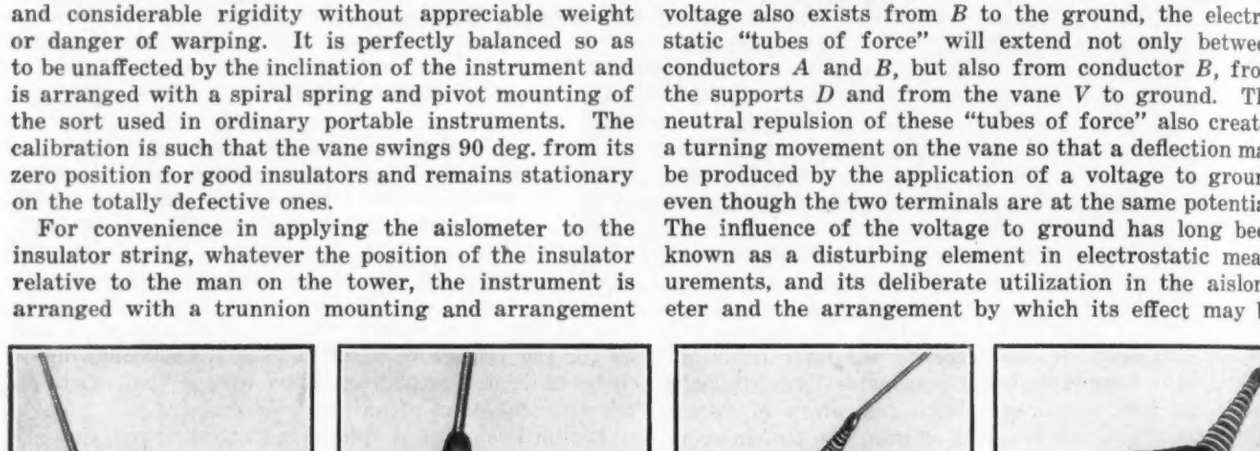


FIG. 2—INSTRUMENT FOR LIVE-LINE TESTING OF INSULATORS HAS PROVED VERY SATISFACTORY IN EUROPE

Left—Model of aislometer for use on strain and suspension insulators. Left, center—Interior of aislometer, showing arrangement of adjustable mounting. Right, center—Back view with adjustable supports and insulating stick. Right—Front view of aislometer and supports. Note location of small paint brush for marking defective units.

The principle of operation of the aislometer may be understood from Fig. 1, where *A* and *B* are the two conductors which are prolonged outside the case inclosed in highly insulated bushings to make contact with the metal on the two sides of the insulator unit being tested, *C* is the insulator bushing which is depended upon principally to give the instrument its high dielectric strength, and *V* is the movable vane, which is perfectly balanced about its shaft and turns in pivots carried by the supports *D*. The vane *V* is in electrical contact with the terminal *B*.

If a difference of potential exists between the terminals *A* and *B*, both ends of the vane *V* are attracted by the conductor *A*, giving a certain resultant turning movement on the vane. If the terminal *B* is at earth potential, these two turning moments acting at an angle on opposite ends of the vane are the only forces tending to produce movement, but if a difference of voltage also exists from *B* to the ground, the electrostatic "tubes of force" will extend not only between conductors *A* and *B*, but also from conductor *B*, from the supports *D* and from the vane *V* to ground. The neutral repulsion of these "tubes of force" also creates a turning movement on the vane so that a deflection may be produced by the application of a voltage to ground even though the two terminals are at the same potential. The influence of the voltage to ground has long been known as a disturbing element in electrostatic measurements, and its deliberate utilization in the aislometer and the arrangement by which its effect may be made large or small constitute one of the principal differences between the design of this instrument and that of the ordinary electrostatic voltmeter or indicator.

The whole set of attracting and repelling forces is so complicated that mathematics is necessary for any quantitative studies, but fortunately the manner of control may be understood in a general way from a few fundamental considerations.

With the vane in its zero position as shown in the sketch, there is a repelling effect between each end of it and each conductor when both conductors are at the same potential to ground and the forces of repulsion on the two ends of the vane are in opposite directions, tending to counterbalance each other except for the inequality in length of the two ends of the vane and the difference in the angles at which these forces are applied. Moving the vane in the direction of its longer end by rotating the supports *D* in a clockwise direction about the conductor *B* brings the short end of the vane more directly into the field of this conductor, increasing the repulsion on it, and the same movement weakens the

TABLE I—DISTRIBUTION OF DEFECTIVES IN STRAIN STRINGS

Distribution of Defective Disks	Number of Strings	Per Cent of Total Strings	Per Cent of Strings with Defectives
Strings with none	2,218	63.6	....
Strings with one	599	17.1	47.0
Strings with two	342	9.8	26.8
Strings with three	236	6.7	18.5
Strings with four	86	2.4	6.7
Strings with five	13	0.4	1.0
Total strain strings tested			3,494
Total strain strings with defectives			1,276
Percentage of strain strings with defectives			36.4
Total strain insulators tested			24,458
Total strain insulators defective			2,400
Percentage of strain insulators defective			9.81
Percentage of strain strings which would have defectives if distribution were uniform			68.7

repulsion on the other end by moving this part of the vane further away and making the line of the repelling forces act at a smaller angle to the vane.

A similar effect, although the forces act in the opposite direction, is obtained on the repulsion from the other conductor, and the net effect on the vane is a turning movement in one direction or the other resulting from the forces exerted by the two conductors on the long and short ends of the vane. Except for certain disturbing factors, such as the attraction of the case and the repulsion of the short end of the vane by the two supports *D*, the effect of changing the vane position by rotating the supports in a clockwise direction is to cause the voltage to ground to oppose the normal movement of the vane, making it necessary to apply a higher voltage difference to the terminals to produce deflection as the voltage to ground increases. The effect of rotation of the supports in the opposite direction is the reverse; that is to say, deflection is produced more easily as the voltage to ground increases.

Increasing the distance between conductors, or decreasing the size and length of the conductor *A* without changing the vane dimensions, has the same effect, so that if desired the effect of voltage difference between conductors can be made practically zero. Between these extremes of adjustment is a position at which practical independence of voltage to ground is secured, but for insulator testing the normal adjustment requires a higher voltage to produce deflection as the line conductor is approached. In this way the adjustment of the aislometer may be made such that it shows not the voltage across the insulator but the proportion of normal voltage across it. It may therefore show an insulator unit near the line as defective whenever the voltage across it is considerably less than normal, even though this voltage is greater than that across a good unit near the grounded end of the string.

A curious characteristic of this instrument, and one that shows the fundamental difference between it and other electrostatic instruments, is that of polarity. No electrostatic voltmeter or indicator of conventional design has polarity when used on alternating-current circuits, yet the aislometer has one terminal, *B* in the sketch, which must normally be toward the line, with the other on the side of the insulator nearest the ground connection. Whenever the voltage to ground is considerable, reversal of the instrument gives reversed or zero readings, a condition suggesting the wattmeter's polarity as regards the direction of flow of power.

TABLE II—PROBABLE DISTRIBUTION OF 2,400 DEFECTIVE INSULATORS IN 3,494 STRINGS OF SEVEN EACH, IF DETERMINED BY CHANCE ALONE (STRAIN STRINGS)

Distribution of Defective Disks in Strings	Probability Per Cent	No. of Strings	Per Cent of Total Strings	Per Cent of Strings with Defectives
Strings with none	46.546	1,697	48.59	....
Strings with one	36.957	1,291	36.95	71.86
Strings with two	12.058	421	12.05	23.43
Strings with three	2.185	76	2.17	4.23
Strings with four	0.238	8	0.23	0.45
Strings with five	0.0155	0.5	0.01	0.03
Total strain strings considered				3,494
Total strain strings with defectives				1,797
Percentage of strain strings with defectives				51.4

One of the most difficult problems in constructing the instrument was that of giving it sufficient sensitivity to operate with low voltages under all conditions and at the same time making it sufficiently rugged to withstand the hard usage that such an instrument is bound to receive on a transmission line. The indication and sensitivity of the instrument are made independent of its position by perfect balancing of the moving element, and permanence of adjustment is secured by making this element entirely of metal. Contradictory as it may seem at first glance, the ruggedness of the instrument is attained largely by making the moving element extremely light, as it weighs only 0.63 gram or 0.02 oz. But in consequence of this lightness no movement or blow on the instrument case or bushings can move it quickly enough to make the moving element bend its shaft, break its jewels or be otherwise deformed except by a force that would crush or break the case as well. For the same reason vibrations and the swinging of the element in service have very little tendency to wear the jewels or dull the pivots, and the instrument as a result is about as rugged as a low-priced watch so that cases of damage in service are relatively infrequent.

FIG. 6—TESTING THREE-PART 25-KV. PIN INSULATORS ON LIVE LINES

In order to insure the safety of the tester and to avoid the possibility of causing a line interruption when testing a string of insulators with several defectives, it was necessary to construct the instrument with practically the electrical characteristics of a strain insulator. It is therefore built for a flashover voltage of 75,000 (a limit fixed by the dimensions of the ordinary strain insulator, which fixes the maximum allowable distance between the instrument bushings), for a puncture voltage well above this amount, with an insulation resistance of infinity as measured with a good megger, and with an electrostatic capacity intermediate between that of a Hewlett disk and that of a 10-in. (25-cm.) cap-and-pin-type strain insulator. Applying the aislometer to an insulator is therefore equivalent to connecting another insulator in parallel with it, and hence no special precautions have to be observed in making the tests.

Having an aislometer which has been calibrated according to the class of insulator, number in string and voltage of line, the testing of strain and suspension units is simplicity itself. The tester, after placing

himself in a convenient position on the tower at a safe distance from the line, applies the instrument to one insulator after another by means of the insulating pole and observes the indication. A full deflection is obtained on all good units, while defectives are indicated by zero or a very slight movement of the vane. The only precautions to be observed are to keep the polarity of the instrument right by keeping the proper terminal toward the line and to be sure that good contact is made with

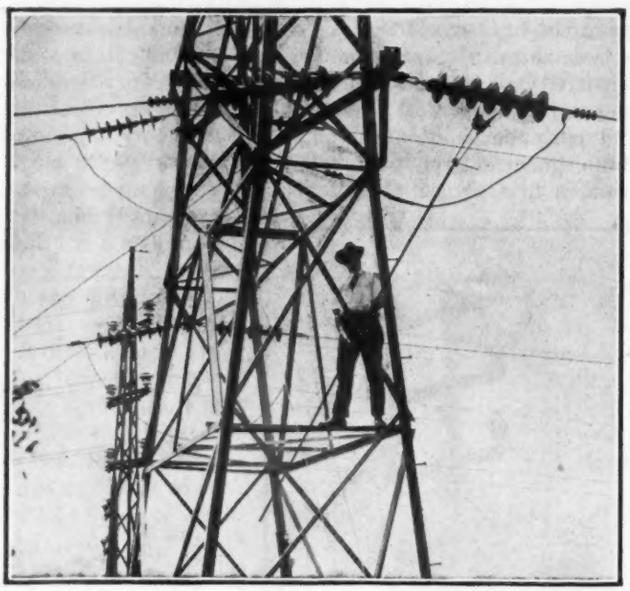


FIG. 7—TESTING STRAIN INSULATORS ON 110-KV. LINE

the connecting pieces of the insulators. As the instrument has approximately the electrical characteristics of a strain insulator, no special precautions have to be observed as to the order of test or manner of applying the instrument, and no error or carelessness on the part of the tester can endanger the service on the line. In the testing of pin-type insulators the procedure is the same, contact being established with the cement between the shells so as to test each shell by itself.

The testing may be done either by one man working alone or by a man and a helper. There is probably no real necessity for the assistant, but legal or other considerations often make the use of one advisable, and in such cases the work may be arranged to utilize the extra man to advantage in the following routine. Arriving at the tower, the tester starts up immediately, carrying one end of a strong cord; the assistant puts the aislometer on the insulating stick, to which he attaches the free end of the cord that has been taken by the tester. As soon as the latter gets into a comfortable and safe position on the tower he pulls up the instrument by means of the cord, unsnaps it and starts testing. By the time he has tested a string of insulators the assistant gets up the tower, carrying a paintpot and a notebook containing special printed forms for recording the number and location of defective insulators.

When a defective unit is found the tester marks it with a daub of red paint applied with a paintbrush which is fixed to the fork that supports the instrument, while the assistant records the disk location on the special sheet and keeps his paintpot ready to renew the paint on the brush when called upon. After marking the defectives it is advisable to repeat the tests in order to check the marking, as mistakes are occasionally detected in this way.

Working in this way on the 110-kv. double-circuit lines of the Ebro system and counting time at the towers only, but excluding the time of passage between towers, which varies over wide limits with the nature of the country, the tester averaged 120 to 140 disks per hour over about 372 miles (600 km.) of line. In these tests he was urged to care rather than speed, and it is probable that better time than this could be made if emphasis were placed on doing the work quickly.

When this instrument is used there is nothing very exciting about sending men out day after day to hunt defective insulators and mark them with a daub of red paint. It is just plain hard work, and the results obtained are pretty nearly proportionate to the amount of hard work put in. As a result of experience it is found best to use carefully selected linemen for the work. The testing does not, however, call for any high degree of technical skill. On the lines of the Riegos y Fuerza del Ebro, S. A., we were prepared to find a fairly large percentage of defective strain and suspension insulators, and in this regard our expectations were fulfilled, the insulators purchased before the war proving even worse than anticipated.

The surprising thing about these tests, however, was the tendency of the defective insulators to group themselves together, there being a much larger number of defective units in some strings than would have been expected by the total percentage of defectives. On a uniform distribution basis one defective disk each would have been found usually in two strings out of three, but instead of this, the actual number of defective insulators found in one string out of three was two, a far more dangerous condition. On going over the network recently it was found that in long stretches of line in flat country there was scarcely a bad insulator, but at isolated towers at the top of mountains, at the end of long spans, etc., nearly every string had one or more defective units. The figures for the whole line, as shown at the first test (Table I), are interesting. On the last test of insulators the towers will be classified according to their location in flat or broken country, in order to determine whether location is any factor.

The danger resulting from insulator depreciation is greatly increased by the tendency of the bad insulators

TABLE III—OPERATING RECORD OF LINES FOR FOUR-YEAR PERIOD

Year and Period	Kilometers of 110-kv. Circuit in Operation: Post Insulator Lines	Kilometers of 110-kv. Circuit in Operation: Suspension Insulator Lines	Kilometers of 110-kv. Circuit in Operation: All Lines	Hour-Kilometers Possible During Period	Operation All Lines Compared with Service Standard Hour-Kilometers Out of Service: For Breakdown	Operation All Lines Compared with Service Standard Hour-Kilometers Out of Service: For Maintenance	Operation All Lines Compared with Service Standard Hour-Kilometers Out of Service: All Causes
1919:							
Jan.-Apr.	299	378	677	1,949,851	1.56	0.26	1.82
May-Aug.	345.5	378	723.5	2,126,866	1.73	0.49	2.22
Sept.-Dec.	222	378	600	1,756,800	0.25	0.52	0.77
Year	289	378	667	5,833,517	1.18	0.42	1.60
1920:							
Jan.-Apr.	286.5	378	664.5	1,900,938	1.50	0.72	2.22
May-Aug.	177	413	580	1,741,792	0.78	0.64	1.42
Sept.-Dec.	230	548	778	2,777,984	0.81	0.28	1.09
Year	231	446	674	5,920,714	1.03	0.55	1.58
1921:							
Jan.-Apr.	230	548	778	2,240,640	0.31	0.28	0.59
May-Aug.	230	548	778	2,296,656	0.85	0.42	1.27
Sept.-Dec.	230	548	778	2,777,984	0.50	0.35	0.85
Year	230	548	778	6,815,280	0.56	0.35	0.90
1922:							
Jan.-Apr.	230	548	778	2,240,640	0.15	0.75	0.90
May-Aug.	224	548	772	2,277,000	0.34	0.40	0.74
Sept.-Dec.	230	548	778	2,277,984	0.09	0.90	0.99
Year	228	548	776	6,795,624	0.19	0.68	0.88
1923:							
Jan.-Apr.	230	548	778	2,240,640	0.29	0.86	1.15
May-Aug.	230	548	778	2,296,656	0.25	0.45	0.70
Sept.-Dec.	.....	.....	.....	.....	.....	.....	.....
8 months	230	548	778	4,537,296	0.27	0.65	0.93

to group themselves together. The factor of safety of a string of insulators is such that a single defective in a string of seven, such as would be the case under a uniform distribution, would not endanger the string or the service of the line at all. Even two defectives in a string would not be really serious. But the factor of safety is reduced almost to the vanishing point when four or five defectives occur in a string of seven, leaving only three or even two disks to sustain the normal line voltage (64 kv. to ground). As indication of this it may be mentioned that there were at least three cases of flashover of such strings between the time they were tested and the time the repair gangs were able to change them. It is probable that the tendency of various defects to develop on insulators of the same strings is even greater than these figures indicate, as each time a group of five defectives occurs it certainly disappears within a few weeks, because of the flashover of the string so weakened, while there is very little tendency for groups of two or three defectives to be eliminated except by test. This is also indicated by the sharp drop in the number of strings having four or five defectives as contrasted with the number having two or three.

Obviously a perfectly uniform distribution of defectives could not be expected under any circumstances, but if the insulator grouping were a matter of chance, as it is when the disks arrive at the warehouse after several effective "shufflings" in factory handling, in packing, in shipment and in distribution over the line, the law of probabilities would give a distribution of defectives as shown in Table II.

Results so far lead to the belief that the failure of the insulator may be caused not so much by mechanical loading as by vibration in regions were the wind is heavy and the conductors may be set vibrating longitudinally. Probably the greatest surprise was received in connection with testing pin-type insulators. The worst case of all was on two 25,000-volt lines which run parallel to the coast in rather rough country, and on these 23 per cent of the good insulators were found to have defective shells. It indicates that there is just as great a necessity of testing pin-type insulators as there is of testing strain and suspension insulators.

Table III gives the results on operation of insulator tests and line maintenance for the last four and a half years on this system. The failures which occur now on the system are due almost entirely to defective strain clamps and the breakage of the porcelain itself, which allows the line to fall. The latter occurrence seems to be due to the fact that at the time these lines were constructed the manufacturers apparently had not yet learned the trick of putting a cardboard gasket under the cap of the insulator to keep it from pushing itself off and breaking the porcelain on a hot day.

Fourteen Systems with Output of More than a Billion Kilowatt-Hours in 1923

THERE were 108 electric light and power companies in the United States and Canada having an output of more than one hundred million kilowatt-hours during 1923. This compares with ninety-four in 1922, an increase of fourteen companies, or 15 per cent. Of this number fourteen reported an output of more than a billion kilowatt-hours during 1923. This compares very favorably with six such companies during 1922, five during 1921, nine during 1920 and six in 1919. Of these super-companies in 1923, eleven were operating in the United States and three in Canada.

The total output of these 108 electric light and power companies was 51,809,127,639 kw.-hr. (estimating the output of the Scranton Electric Company at 136,000,000 kw.-hr. and that of the Minneapolis General Electric Company at 475,000,000 kw.-hr.). Deducting the output of the Canadian systems gives 44,869,638,877 kw.-hr. as the output of the electric light and power companies in the United States having an annual output in excess of one hundred million kilowatt-hours.

Table I is believed to be a complete list of the electric light and power companies and electric railway companies of the United States and Canada with an output in excess of a hundred million kilowatt-hours during 1923, giving their total output, the amount and date of their peak load and the average load carried during the year. In order that the peak-load data of the various companies might be comparable a special request was made that if the peak load reported were not over a thirty-minute period such a figure be furnished. In a large number of cases it was necessary to estimate this thirty-minute peak-load figure. These data will also be found in Table I. A column in this tabulation added this year gives the average load of these companies for 1923. The total average load of all the 102 companies in the United States was 5,122,105 kw.

The Niagara Falls Power Company again led the country, reporting a total output of 2,595,847,000 kw.-hr., all of which was generated in its own plants. The Commonwealth Edison Company of Chicago was a very close second, with 2,573,286,711 kw.-hr., of which 99.1 per cent was generated in its own plants. The New York Edison Company and the United Electric Light & Power Company combined were third. The Hydro-Electric Power Commission of Ontario, however, reported the largest output of all the systems in the world with 2,906,519,819 kw.-hr.

The largest peak load was reported by the Commonwealth Edison Company with 624,000 kw., followed by the Edison-United companies of New York with 536,533 kw. over a thirty-minute period and an instantaneous peak load of 555,433 kw.

Table II lists these companies by sections of the country and gives the proportion of the output which was generated, the amount of energy purchased and also the distribution of the energy. The 102 companies operating in the United States generated 39,926,114,797 kw.-hr. (estimating the energy generated by the Scranton Electric Company at 128,000,000 kw.-hr. and that generated by the Minneapolis General Electric Company at 425,000,000 kw.-hr.). This figure is approximately 83 per cent of the energy generated by all the central stations in the United States during 1923. Several companies do not give their distribution figures as between light and power, but approximately twenty-five billion kilowatt-hours was distributed by those 102 companies for light and power purposes. Tables I and II will be found on the four following pages.

Table I—Data on Output and Peak Load of Largest Generating and Distributing Companies in the United States and Canada

(These data include all lighting, power and electric railway companies in the United States and Canada having yearly output in excess of 100,000,000 kw.-hr. during 1923)

Company	Rank in 1923	1923					1922			1921			1920		
		Peak Load, Kw.	Peak Load (Estimated Over Thirty Minute Period), Kw.	Date of Peak	Output for Year, Kw.-Hr.	Average Load During 1923, Kw.	Peak Load, Kw.	Date of Peak Load	Output for Year, Kw.-Hr.	Peak Load, Kw.	Date of Peak Load	Output for Year, Kw.-Hr.	Peak Load, Kw.	Date of Peak Load	Output for Year, Kw.-Hr.
United States															
Niagara Falls Power Co.	1	356,515 (a)	.....	Dec. 28	2,595,847,000	296,329	328,826	Nov. 23	2,252,249,000	298,120	Dec. 22	1,855,120,000	303,640	Apr. 29	2,328,326,064
Commonwealth Edison Co.	2	624,000	624,000	Dec. 4	2,573,286,711	293,756	600,000	Dec. 12	2,225,442,875	525,640	Dec. 21	1,928,271,943	478,820	Dec. 17	1,883,570,000
New York Edison & United Elec. Light & Power Cos.	3	555,433 (a)	536,533	Dec. 5	1,899,679,975	217,000	497,577	Dec. 20	1,659,269,781	422,721	Dec. 14	1,475,276,053	398,535	12/6 and 12/22	1,383,070,086
Pacific Gas & Electric Co.	4	306,945	306,945	Dec. 12	1,725,619,492	196,989	293,708	Nov. 10	1,608,940,735	265,925	Nov. 29	1,489,088,657	259,004	Dec. 22	1,475,678,673
Southern California Edison Co.	5	312,500	.....	Oct. 17	1,548,896,120	173,248	239,160	Aug. 28	1,198,926,369	238,480	Dec. 13	1,224,718,196	213,450	July 12	1,079,474,091
Detroit Edison Co.	6	303,600	303,600	Dec. 5	1,360,017,300	155,300	254,700	Dec. 7	1,105,211,100	201,500	Nov. 23	897,980,200	218,800	June 16	1,002,306,000
Philadelphia Electric Co.	7	299,438 (a)	289,200 (e)	Dec. 27	1,148,511,101	135,785	260,355	Dec. 14	956,910,225	213,570	Dec. 8	877,047,595	203,624	Nov. 23	910,327,693
Montana Power Co.	8	156,500 (f)	156,500	July 26	1,122,750,450	128,168	135,600	Aug. 10	963,662,660	116,600	Jan. 11	572,277,989	159,700	Aug. 7	1,103,620,644
Public Service Electric Co.	9	282,654 (a)	280,500	Dec. 5	1,084,990,294	122,700	249,778	Dec. 18	958,407,194	213,502	Nov. 28	821,198,975	216,452	Nov. 16	912,899,972
Duquesne Light Co.	10	219,500	.....	Nov. 20	1,063,046,267	119,477	208,980	Dec. 13	858,329,336	164,240	Feb. 1	702,897,985	162,000	Jan. 29	810,401,406
Southern Power Co.	11	270,800 (f)	.....	Dec. 11	1,001,026,319	114,272	233,000	July	910,488,432	218,300	Feb.	790,000,000	210,000	Nov.	745,873,992
West Penn System	12	181,000	.....	Dec. 18	945,691,000	108,000	137,354	Dec. 11	634,674,505	106,919	Dec. 21	516,829,636	104,618	Nov. 24	524,976,000
Cleveland Electric Illuminating Co.	13	187,275 (a)	184,800	Dec. 20	802,859,991	91,651	181,112	Dec. 14	688,149,162	141,850	Dec. 15	564,819,267	155,041	Sept. 9	682,557,097
Alabama Power Co.	14	178,200 (b)	160,000	Nov. 5	763,260,963	87,100	153,100	Dec. 18	607,133,242	115,500	Dec. 20	232,991,540	97,900	Sept. 28	488,089,061
Buffalo General Electric Co.	15	154,800 (a)	152,500	Dec. 20	707,958,270	80,800	142,000	Dec. 7	587,682,340	115,000	Nov. 14	479,862,700	108,500	Oct. 26	544,293,410
Niagara, Lockport & Ontario Power Co.	16	142,000	142,000	Dec. 13	707,087,842	80,718	127,000	Nov. 24	552,035,090	87,000	Nov. 2	415,153,634	88,000	Jan. 6	492,466,460
Consol. Gas, Elec. Lt. & Power Co. of Baltimore	17	138,410 (f)	.....	Dec. 19	678,346,746	77,437	138,800	Dec. 13	568,669,404	108,330	Nov. 30	415,335,614	88,990	Nov. 30	429,710,847
Union Elec. Light & Power Co.	18	154,136 (a)	151,053	Dec. 19	650,310,260	74,237	134,100	Nov. 27	554,551,123	116,275	Dec. 9	508,893,262	105,749	Dec. 21	471,611,047
Northern States Power Co.	19	149,196 (a)	144,989	Nov. 26	636,428,456	72,652	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mississippi River Power Co.	20	129,400 (b)	125,000	June 5	632,715,867	72,228	122,300	June 14	619,837,527	117,450	Nov. 28	602,580,980	115,650	Nov. 13	644,163,000
Utah Power & Light Co.	21	105,452 (b)	.....	Dec.	621,977,000	71,000	87,158	Dec. 19	428,962,903	75,661	Jan. 8	362,908,000	85,404	Nov.	519,854,000
Pennsylvania Power & Light Co.	22	116,453 (b)	.....	Nov.	602,691,800	68,800	106,987	Nov. 14	495,344,612	84,203	Sept. 27	442,507,974	87,685	Sept.	411,639,501
Brooklyn Edison Co.	23	180,000 (a)	174,000	Dec. 20	598,808,757	68,357	164,495	Dec. 7	516,987,870	137,800	Dec. 6	438,887,775	116,500	Nov. 30	382,963,027
Great Western Power Co.	24	116,800 (a)	116,800	Dec. 12	589,597,024	65,673	105,910	Dec. 5	572,693,958	95,540	June 7	490,584,257	80,600	July 27	408,577,754
Puget Sound Power & Light Co.	25	124,300 (a)	124,300 (e)	Dec. 19	577,578,440	65,933	105,600	Dec. 4	474,042,886	99,800	Dec. 1	419,197,581	95,725	Dec. 3	472,765,800
New England Power Co.	26	139,314 (f)	.....	Oct. 23	575,067,581	65,647	125,460	Dec. 14	469,993,180	112,200	Nov. 9	405,979,457	103,450	Jan. 6	430,918,000
Consumers' Power Co.	27	139,849 (a)	137,052	Sept. 18	574,031,472	65,529	116,130	Dec. 4	461,840,561	95,410	Dec. 12	397,815,027	106,924	May 19	476,095,098
Milwaukee Electric Ry. & Light Co.	28	138,291 (a)	138,291	Nov. 27	553,624,392	63,427	134,482	Dec. 19	458,405,215	98,887	Nov. 22	375,354,892	90,347	Jan. 6	398,619,744
Edison Elec. Illum. Co. of Boston	29	153,123 (d)	.....	Dec. 10	526,465,178	60,099	133,594	Dec. 14	439,448,099	128,200	Dec. 15	375,025,955	105,090	Dec. 9	395,076,738
San Joaquin Light & Power Corp.	30	73,425	73,425	July 27	465,458,706	53,154	67,885	Aug. 4	451,390,040	61,700	June 27	396,174,690	47,180	Aug. 28	299,536,000
Tennessee Electric Power Co.	31	93,700 (f)	97,500	Mar. 5	460,097,505	52,500	82,700	Dec. 11	353,320,559	69,100	May 16	342,948,926	74,800	4/3–6/4	428,649,835
Union Gas & Electric Co.	32	112,000 (c)	107,000	Dec. 20	438,386,388	50,044	100,000	Dec. 13	366,071,350	75,000	12/14 and 12/23	281,537,273	65,050	Dec. 21	234,634,375
Public Service Co. of No. Illinois	33	(h) 98,017 (a)	96,943	Dec. 4	427,460,666	48,797	82,737	Dec. 19	362,220,201	80,563	Dec. 30	415,940,095	.....	.....	.....
Los Angeles Bureau of Power & Light.	34	98,945 (a)	98,096	Dec. 13	426,337,964	48,669	75,275	Dec. 15	318,502,702	51,900	Dec. 21	300,353,806	46,500	Dec. 29	169,489,210
Pennsylvania Water & Power Co.	35	85,000 (a)	84,400	Jan. 3	420,028,600	47,900	83,000	June 10	373,341,800	83,000	Nov.	419,987,000	85,000	.....	494,624,400
Ohio Public Service Co.	36	92,723	.....	Dec.	415,424,787	47,423	80,080	Nov.	316,838,000	.....	.....	.....	.....	.....	.....
Washington Water Power Co.	37	86,487 (a)	84,955	Nov. 9	413,240,900	46,487	89,278	Dec. 12	407,657,100	70,110	Nov. 23	374,378,300	63,955	Jan. 21	351,087,900
Adirondack Power & Light Co.	38	82,895	.....	Nov. 26	380,630,188	43,451	81,100	Dec. 14	304,997,551	61,500	Dec. 21	243,370,354	60,700	Dec. 2	277,100,000
Narragansett Electric Lighting Co.	39	88,000	.....	Nov. 21	373,505,000	42,638	85,000	Dec. 4	297,400,000	72,000	Nov. 23	243,087,000	54,000	1/5 and 11/6	213,232,000
Portland Railway, Light & Power Co.	40	81,500 (f)	81,800	Dec. 20	365,997,750	41,780	71,800	Dec. 28	324,116,190	64,800	Dec. 20	298,514,571	62,600	Dec. 6	292,318,971
Georgia Railway & Power Co.	41	91,500 (a)	85,000	Oct. 4	358,353,618	40,800	80,000	Nov. 15	317,068,699	72,000	11/ 3 and 11/28	282,084,977	76,000	Apr. 9	293,721,290
Pennsylvania-Ohio Electric Co.	42	61,100 (f)	61,100	Jan. 19	340,864,488	38,911	64,200	Nov. 20	276,936,464	45,300	Nov. 9	202,670,200	48,900	Nov. 3	255,537,150
Kansas City Power & Light Co.	43	62,800	.....	Sept. 27	289,903,699	34,450	59,490	Dec. 6	253,305,000	50,531	Dec. 23	204,752,604	35,500	Dec. 23	175,939,618
Toledo Edison Co.	44	73,000	73,000	Dec. 5	273,643,372	31,238	58,000	Dec. 14	215,785,945	46,700	Dec. 13	179,121,428	52,400	Mar.	207,830,610
Potomac Electric Power Co.	45	70,000 (a)	68,160	Dec. 27	269,870,850	30,807	70,000	Dec. 20	251,984,618	65,000	Dec. 14	238,028,571	62,000	Nov. 30	225,994,701
Virginia Railway & Power Co.	46	56,400 (f)	62,000	Dec. 18	262,940,313	30,000	54,250	Dec. 18	230,293,745	47,000	Dec. 14	208,323,000	46,150	Dec. 22	208,517,000
Michigan Northern Power Co.	47	34,510 (g)	.....	Oct. 19	261,577,017	29,860	32,449	Nov. 3	246,175,203	35,018	Aug. 14	258,249,673	35,408	Nov. 12	257,752,195
Northern Ohio Traction & Light Co.	48	46,400	46,400	Dec. 10	259,720,216	29,100	43,000	Dec.	232,684,874	42,000	Oct. 12	187,249,647	44,400	May	247,109,963
Minnesota Power & Light Co.	49	50,300 (b)	.....	May 22	251,144,646	28,950	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rochester Gas & Electric Co.	50	61,824 (a)	56,124	Dec. 6	248,156,900	28,330	53,040	Nov. 23	193,503,573	48,734	Dec. 16	185,480,692	49,400	Oct. 29	193,601,590
Appalachian Power Co.	51	47,800 (f)	.....	.....	244,600,000	27,900	42,600	Dec. 4	205,447,368	35,600	Dec. 19	154,500,000	35,300	Oct.	148,700,000
Fort Worth Power & Light Co.	52	45,067 (b)	.....	Dec. 18	240,662,700	27,472	38,500	Dec. 21	178,790,374	29,500	Oct. 15	163,286,500	.....	.....	.....
Columbus Railway, Power & Light Co.	53	53,200	53,200	Nov. 23	231,641,760	26,443	52,100	Dec. 14	187,785,967	38,440	Dec. 12	160,423,240	.....	.....	153,626,000
Texas Power & Light Co.	54	37,570 (b)	.....	Dec. 17	225,453,000	25,736	66,560	Dec. 13	183,536,613	33,620	Sept. 22	156,851,213	33,620	Oct. 14	159,939,831
Idaho Power & Light Co.	55	40,016 (b)	.....	Aug.	222,590,000	25,410	38,323	July 24	212,237,000	35,635	Sept. 1	190,215,255	34,235	July	184,843,000
Southern Sierras Power & Nevada-Calif. Power Co.	56	40,100	.....	June 11	219,653,900	25,011	36,200	July 14	186,671,850	45,700	6/6 and 8/8	199,452,965	32,600	July 23	175,104,808
	57	39,600 (f)	39,600	June 13	217,138,000	24,800	56,400	May 16	201,796,000	57,900	May 17	170,826,000	55,500	May 27	212,126,530

Southern Sierras Power & Nevada-Calif. Power Co.	56	40,100		June 11	219,653,900	25,011	36,200	July 14	186,671,850	45,700	6/6 and 8/8	199,452,965	32,600	July 23	175,104,808
Turners Falls Power & Light Co.	57	59,600 (f)	59,600	June 13	217,138,000	24,800	56,400	May 16	201,796,000	57,900	May 17	170,826,000	55,500	May 27	212,126,530
New Orleans Public Service, Inc.	58	51,700 (b)		Dec.	211,765,420	24,174	46,500	Dec. 13	188,000,000						
North West Utilities and Eastern Wisconsin Elec. Co.	59	43,439	43,439	Sept.	203,997,334	23,287	43,589	Dec.	163,902,506	31,885	Apr.	132,788,852			
Dayton Power & Light Co.	60	58,500(c)	57,000	Dec. 10	196,615,340	22,444	46,500	Dec. 8	159,836,687	37,500	Nov. 28	134,588,457	31,500	5/25 and 9/28	129,618,270
Connecticut Light & Power Co.	61	50,900 (f)	53,450	Dec. 5	196,432,892	22,400	45,706	Dec. 14	158,371,247	28,255	Nov. 28	101,129,915	33,392	Oct. 12	145,111,822
Penn. Public Service Corp.	62	57,000 (a)	48,000	Jan.	182,281,000	20,808									
Hartford Electric Light Co.	63	60,200 (a)	58,500	10/23-11/22	181,202,880	20,685	56,000	Dec. 14	134,000,000	31,700	Nov. 14	97,754,000	32,500	Jan. 9	103,000,000
Central Illinois Pub. Service Co.	64	42,300	42,300	Sept. 5	174,670,219	19,941	30,800	Oct.	128,345,120	26,300	Dec.	114,587,986			
Indianapolis Light & Heat Co.	65	39,478	39,478	May 8-11	169,453,319	19,350	38,236	Dec. 14	138,356,280	29,350	Nov. 9	108,829,278	27,240	Sept. 15	114,416,090
Metropolitan Edison Co.	66	41,600	41,000	Dec.	168,814,810	19,271	32,100	Nov. 20	127,315,007	27,900	Nov. 30	99,815,200	28,000	Aug. 10	133,994,030
Yadkin River Power Co.	67	48,600 (b)		Dec.	165,846,240	18,932	37,000	Nov. 8	142,161,182						
Virginian Power Co.	68	47,645		Dec.	163,147,137	18,624									
Birmingham Railway, Light & Power Co.	69	35,202 (b)		Dec. 5	162,443,207	18,544									
Nebraska Power Co.	70	34,000 (b)		Dec. 19	160,624,600	18,335	30,200	Dec. 6	140,272,500	28,200	Oct. 28	127,758,800	25,500	Nov. 26	114,200,500
Kansas Gas & Electric Co.	71	33,000 (b)		Dec. 3	160,464,200	18,300	29,600	Dec. 7	139,167,200	25,000	Dec.	130,479,900			
Columbus Electric & Power Co.	72	36,310	36,310	Oct. 16	160,246,106	18,293									
Syracuse Lighting Co.	73	38,071 (d)	37,200 (e)	Nov.	159,670,385	18,227	33,686	Dec. 8	124,457,748						
Indiana & Michigan Electric Co.	74	37,970 (f)	41,500	May 8	156,333,990	17,846	37,450	Dec. 4	136,825,060	28,280	Dec. 16	105,593,490	27,130	Nov. 9	103,693,910
California-Oregon Power Co.	75	32,463	32,463	Nov. 20	153,500,531	17,523	27,695	Dec. 20	131,293,165	20,270	Mar. 16	133,091,607	20,335	Jan. 28	143,025,818
Northwestern Electric Co.	76	30,900 (f)	31,000	Dec. 19	152,702,800	17,411	22,700	Dec. 29	120,698,840	22,190	Dec. 12	113,913,335	20,600	Dec. 10	112,736,089
Empire District Electric Co.	77	58,826		May	152,681,540	17,400									
American Public Utilities Co.	78	36,000		Dec.	148,000,000	16,895									
Penn. Central Light & Power Co.	79	36,100 (a)	35,700	Dec. 20	147,423,930	16,890									
United Light & Railways Co.	80	34,785		Dec. 24	146,987,476	16,800	35,505		129,236,964						
Central Maine Power Co.	81	32,200		Dec. 3	146,136,310	16,700	32,500	Dec. 11	128,445,419						
Public Service Co. of Colorado	82			Dec.	145,302,874	16,587	28,800	Dec.	102,631,000						
New York & Queens Electric Light & Power Co.	83	40,650 (a)	39,583	Dec. 5	143,749,060	16,409	35,300	Nov. 15	120,011,093						
Cleveland Mun. Electric Light Plant	84	29,100	29,100	June 28	138,592,090	16,000	25,300	Dec. 14	116,355,460						
Colorado Power Co.	85	29,776		July 31	137,345,406	15,679	25,777	July	116,711,939	25,961	Mar. 9	113,805,044	29,078	Oct. 1	116,748,292
Tacoma Department Light and Water	86	29,600	29,600	Dec. 7	136,757,822	15,611	31,900	Dec. 5	112,546,832	28,400	Dec. 20	95,697,600	22,700	Nov. 10	120,598,174
New Bedford Gas & Edison Light Co.	87	47,782 (a)	45,500	Jan. 3	133,707,946	15,280	47,500	Dec. 18	115,938,294	40,300	Dec. 21	89,857,700	33,700	June 17	107,599,392
Utica Gas & Electric Co.	88	36,550 (a)	35,000	Dec.	130,921,606	14,945									
Houston Lighting & Power Co.	89	27,400 (b)		Dec. 3	129,318,120	14,762	24,200	Nov. 22	108,646,517						
Los Angeles Gas & Electric Corp.	90	43,500	43,500	Dec. 18	127,357,201	14,563									
East St. Louis & Suburban Co.	91	25,300	25,300	Feb. 27	126,969,671	14,494									
Blackstone Valley Gas & Elec. Co.	92	40,060 (f)	43,500	Dec. 10	126,621,397	14,430	38,030	Dec. 20	110,225,488						
Pacific Power & Light Co.	93	25,000 (b)		Sept.	116,676,395	13,319									
Cohoes Power & Light Corp.	94	27,000 (f)		Jan. 3	115,661,600	13,203	28,000	Dec. 20	103,195,985						
Seattle Municipal Light & Power Department	95	35,600 (a)	34,500	Dec. 7	115,431,550	13,150									
Tri-City Railway & Light Co.	96	26,930 (d)	25,000	Feb. 13	113,215,301	12,924									
Potomac Public Service Co.	97	25,450		Sept. 25	112,820,766	12,879									
Worcester Electric Light Co.	98	34,400		July 13	109,999,561	12,340									
Dallas Power & Light Co.	99	16,300		Dec. 3	105,400,728	12,032									
Edison Electric Co., Lancaster	100	24,600 (b)	24,600	Nov. 27	100,205,700	11,439									
Scranton Electric Co.		No report received.													
Minneapolis General Electric Co.		No report received													
Canada															
Hydro-Electric Power Commission of Ontario	1	520,084		Nov. 27	2,906,519,819	331,795	460,471	Dec. 13	2,392,092,267						
Shawinigan Water & Power Co.	2	272,500	272,500	Nov. 7	1,667,397,876	190,342	250,000	Dec. 19	1,383,390,773	166,500	Dec. 19	863,124,240	192,200	Nov. 17	1,140,759,076
Montreal Light, Heat & Power Consol.	3	197,565	197,565	Nov. 8	1,089,099,507	124,326	185,500	Nov. 27	945,200,656	165,900	Nov. 16	907,237,573	169,450	Nov. 17	900,328,757
Ontario Power Co. of Niagara Falls	4	151,500 (e)	151,500	Jan. 17	982,313,100	112,136	213,100	Jan. 30	994,000,000	151,000	Jan. 5	825,115,600	152,000	Dec. 15	1,061,596,054
City of Winnipeg	5	39,835 (a)	39,600	Nov. 20	164,609,860	18,800	38,048	Dec. 11	144,509,000	34,264	Nov. 23	125,124,855			
Western Power Co. of Canada	6	32,700 (a)	33,700	Dec. 29	129,548,600	14,789				27,200	Mar. 1	122,684,800			
Electric Railways															
Interborough Rapid Transit	1	254,850 (f)	261,950	Mar. 29	960,340,481	109,625	246,770	Jan. 24	886,223,920	242,760	Dec. 30	846,487,668	242,020	Jan. 31	816,603,610
Chicago Surface Lines	2	170,485		Dec. 13	576,457,379	60,205			735,246,576			712,683,840			
Williamsburgh Power Plant Corp.	3	126,200 (f)	131,000	Jan. 17	449,827,260	51,314	118,800	Jan. 24	413,992,125	116,000	Dec. 22	383,009,325	111,147	Jan. 15	389,784,451
Philadelphia Rapid Transit Co.	4	115,154	115,154	Jan. 17	383,313,078	43,757	110,446	Dec. 19	346,506,580	105,303	Dec. 22	333,222,786	102,210	Jan. 14	349,027,334
Boston Elevated Railways Co.	5	82,965 (f)	86,000	Dec. 19	257,983,320	29,382	78,755	Dec. 13	240,547,615	75,905	Jan. 18	223,061,330	72,295	Jan. 14	246,312,170
Pennsylvania R.R. Co.	6	70,600 (f)	70,600	Feb. 15	244,113,039	26,551	72,000	Dec. 30	214,906,725	64,000	Dec. 30	201,922,210	55,200	Jan. 5	199,737,907
Pacific Electric Railway	7	43,000 (a)	43,000	Dec. 21	198,211,000	22,627									
New York Central R.R. Co.	8	47,120		Jan. 25	163,895,940	18,709	48,470	Jan. 3	157,450,819	50,750	Dec. 23	149,275,239	46,440	Dec. 27	157,132,366
Twin City Rapid Transit Co.	9	51,218 (f)	59,000	Feb. 13	146,605,919	16,736	47,005	Dec. 14	145,675,337	44,599	Feb. 8	145,517,164	42,700	Dec. 21	139,711,248
Kansas City Railways Co.	10	42,600 (a)		Feb. 14	128,302,650	14,647	40,200	Dec. 12	123,830,190	43,500	Jan. 13	129,804,772	51,740	Jan. 8	189,172,898
Chicago, Milwaukee & St. Paul Railway Co.	11				122,643,791										

(a) Highest instantaneous peak load.
(b) Average peak load over a five-minute period.
(c) Average peak load over a ten-minute period.
(d) Average peak load over a fifteen-minute period.
(e) Average peak load over a twenty-minute period.
(f) Average peak load over a one-hour period.
(g) Average peak load over an eight-hour period.
For average peak load over thirty-minute period see column 4.

(h) Does not include 10,000 kw. load carried at Blue Island station and prorated to the Commonwealth Edison Company.
Blank indicates that no report was received.

Table II—1923 Detailed Output and Distribution Data for North American Systems

Section and System	Generated and Purchased Output in Kw.-Hr.			Distribution of Energy in Kilowatt-Hours					
	Total Output	Generated	Purchased	Light	Power	Light and Power	Electric Railways	Other Public Utilities	Intra-Company Business and Line Losses, etc.
New England States									
New England Power Co.	575,067,581	268,062,425	307,005,156	0	241,981,680	241,981,680	37,983,922	215,201,241	79,900,738
Edison Electric Illuminating Co. of Boston	526,465,178	509,916,900	16,548,278			332,205,025	9,211,768	64,607,112	120,441,273
Narragansett Electric Lighting Co.	373,504,000	359,746,000	13,758,000	37,233,000	99,326,000	136,559,000	336,490	156,000,000	80,609,510
Turners Falls Power & Electric Co.	217,138,000	192,934,000	24,204,000	0	73,879,000	73,879,000	32,214,000	86,269,000	24,776,000
Connecticut Light & Power Co.	196,432,892	129,646,404	66,786,488	25,431,350	94,241,915	119,673,265	21,355,054	16,350,673	39,053,900
Hartford Electric Light Co.	181,202,880	175,630,080	5,572,800	31,276,481	54,565,880	85,842,361	0	76,877,414	18,483,105
Central Maine Power Co.	147,136,310	133,405,850	13,730,460	22,814,272	72,941,487	95,755,759	14,000,000	788,060	35,592,491
New Bedford Gas & Edison Light Co.	133,707,946	133,707,946	0	10,709,466	105,215,664	115,925,130	1,496,490	0	16,286,326
Blackstone Valley Gas & Electric Co.	124,094,235	73,441,624	50,652,611	12,267,458	78,981,471	91,248,929	4,477,749	10,695,126	17,672,431
Worcester Electric Light Co.	109,999,561	98,596,100	11,403,461	25,671,498	47,526,989	73,198,487	0	24,166,823	12,634,251
Middle Atlantic States									
Niagara Falls Power Co.	2,595,847,000	2,595,847,000	0	571,000	1,572,577,000	1,573,148,000	9,021,000	838,555,000	175,123,000
New York Edison and United Electric Light & Power Cos.	1,899,679,975	1,897,844,955	1,835,020			1,070,476,938	228,912,665	29,697,319	570,593,053
Philadelphia Electric Co.	1,148,511,101	1,148,511,101	0	249,449,484	446,247,890	695,697,374	(b) 273,695,885	30,255,573	148,862,269
Public Service Electric Co.	1,084,990,294	1,053,906,064	31,084,230	239,863,721	424,925,206	664,788,927	190,168,465	554,500	229,478,402
Duquesne Light Co.	1,063,046,267	1,046,618,770	16,427,497	199,312,418	429,633,502	628,945,920	238,621,918	37,917,396	157,561,033
West Penn System	945,691,000	944,563,000	1,128,000	78,249,000	597,337,000	675,586,000	(c) 80,210,000	35,219,000	154,676,000
Buffalo General Electric Co.	707,958,270	191,984,240	515,974,030	142,936,574	392,458,015	535,394,589	75,197,600	0	97,366,081
Niagara, Lockport & Ontario Power Co.	707,087,842	159,389,476	547,698,366			150,780,062	90,099,278	372,667,980	93,540,522
Pennsylvania Power & Light Co.	602,691,800	509,851,700	92,840,100	62,312,206	401,021,186	463,333,392	49,816,716	14,698,747	74,842,945
Brooklyn Edison Co., Inc.	598,808,757	571,699,700	27,109,057	198,064,751	236,508,247	434,572,998	1,875,075	8,548,240	153,812,444
Pennsylvania Water & Power Co.	420,028,600	420,028,600	0	0	0	0	0	371,472,905	48,535,650
Adirondack Power & Light Corp.	380,630,188	300,816,187	79,814,001	23,391,530	124,922,014	148,313,549	95,424,840	67,345,818	(a) 69,545,981
Rochester Gas & Electric Corp.	248,156,900	210,064,128	38,092,772	88,210,585	67,059,742	155,270,327	41,266,328	8,410,445	43,209,800
Penn. Public Service Corp.	182,281,000	181,671,000	610,000	21,768,000	114,463,000	136,231,000	1,728,000	11,037,000	33,285,000
Metropolitan Edison Co.	168,814,810	147,131,370	21,683,440	15,604,422	71,301,113	86,905,535	19,891,340	37,311,591	24,706,344
Syracuse Lighting Co.	159,670,385	0	159,670,385	25,166,499	113,766,809	138,933,308	2,523,669	4,424,240	13,789,168
Penn Central Light & Power Co.	147,423,930	146,303,500	1,120,430	17,355,716	93,618,729	110,974,445	1,451,893	1,727,831	33,269,761
New York & Queens Electric Light & Power Co.	143,749,060	3,560,400	140,188,660	51,497,937	64,601,632	116,099,569	2,894,080	0	24,755,411
Utica Gas & Electric Co.	130,921,606	122,432,956	8,488,650	15,281,781	46,823,824	62,105,605	0	43,282,686	25,533,315
Cohoes Power & Light Co.	115,661,600	108,250,700	7,410,900	2,259,938	45,559,191	47,819,129	0	58,488,871	9,353,600
Edison Electric Co., Lancaster	100,205,700	0	100,205,700	12,969,705	46,371,297	59,341,002	19,690,810	4,758,987	16,414,901
South Atlantic States									
Southern Power Co.	1,001,026,319	917,470,340	83,555,979			578,995,398		(d) 230,170,613	191,860,308
Consol. Gas, Electric Light & Power Co. of Baltimore	678,346,746	407,495,046	270,851,700	(e) 112,943,652	342,122,117	455,065,769	148,823,926	0	74,447,051
Georgia Railway & Power Co.	358,353,618	237,253,865	121,099,753	43,693,167	151,757,960	195,451,127	64,947,783	37,310,502	60,644,206
Potomac Electric Power Co.	269,870,850	269,865,217	5,633	82,915,304	48,323,776	131,239,080	92,038,864	2,200,300	44,392,606
Virginia Railway & Power Co.	262,940,313	246,820,593	16,119,720						
Appalachian Power Co.	244,600,000	244,600,000	0	5,500,000	195,000,000	200,500,000	0	20,000,000	24,100,000
Yadkin River Power Co.	165,846,240	101,855,910	63,990,330	6,411,630	56,052,912	62,464,542	0	80,148,233	23,233,465
Virginian Power Co.	163,147,137	162,853,900	293,237	0	103,774,977	103,774,977	0	46,008,652	13,363,508
Columbus Electric & Power Co.	160,246,106	152,015,088	8,231,018	4,084,311	89,543,267	93,627,578	0	47,506,256	19,112,272
Potomac Public Service Co.	112,820,766	106,998,443	5,822,323	7,625,180	75,954,401	83,579,581	6,386,735	0	22,854,450
East North Central States									
Commonwealth Edison Co.	2,573,286,711	2,550,223,890	23,062,821	727,422,579	663,204,138	1,390,626,717	775,159,124	99,469,682	308,031,188
Detroit Edison Co.	1,360,017,300	1,359,910,800	106,500	267,693,195	670,784,067	938,477,262	148,284,370	40,114,483	233,141,185
Cleveland Electric Illuminating Co.	802,859,991	802,859,991	0	(f) 141,476,815	( ) 411,645,584	553,122,399	140,741,782	6,850,490	102,145,320
Consumers' Power Co.	574,031,472	541,803,447	32,228,025	105,143,241	267,783,891	372,927,132	67,409,463	2,825,979	130,868,898
Union Gas & Electric Co.	438,386,388	432,578,388	5,808,000	(h) 70,239,342	174,912,444	245,151,786	59,748,329	48,185,329	49,221,220
Public Service Co. of No. Illinois	427,460,666	(i) 349 033,433	78,427,223	(j) 64,623,222	(k) 189,684,611	254,307,833	46,993,461	43,203,544	82,955,828
Ohio Public Service Co.	415,424,787	341,211,837	74,212,950	30,468,495	298,318,218	328,786,713	0	47,603,822	39,034,252
Pennsylvania-Ohio Electric Co.	340,864,488	334,171,155	6,693,333	45,940,905	206,978,242	252,919,147	37,914,551	15,629,637	34,401,153
Toledo Edison Co.	273,643,372	273,643,372	0	50,150,359	116,254,727	166,405,086	44,340,779	7,964,180	54,933,327
Michigan Northern Power Co.	261,577,017	261,577,017	0	2,960	260,094,004	260,096,964	687,400	443,900	348,753
Northern Ohio Traction & Light Co.	259,720,216	182,182,550	77,537,666	40,484,750	102,607,868	143,092,618	54,727,216	14,375,645	47,524,737
Columbus Railway, Power & Light Co.	231,641,760	231,641,760	0	48,413,440	101,347,068	149,760,508	33,894,346	0	47,986,906
Dayton Power & Light Co.	196,615,340	196,613,340	0	32,763,480	81,292,894	114,056,374	41,713,960	11,230,380	29,614,626
Central Illinois Public Service Co.	174,685,799	123,857,148	50,828,651	(l) 30,810,736	(m) 14,086,984	44,897,720	0	78,345,426	51,442,653
Indianapolis Light & Heat Co.	169,453,319	169,453,319	0	18,966,738	99,333,707	118,300,445	0	14,149,618	37,003,256
Indiana & Michigan Electric Co.	156,333,990	156,333,990	0	20,762,956	58,985,646	79,748,602	12,441,939	36,606,902	27,536,547
American Public Utilities Co.	148,000,000	133,000,000	15,000,000	43,000,000	55,000,000	98,000,000	600,000	20,000,000	29,400,000
United Light & Railways Co.	146,987,474	103,486,480	43,500,994	31,756,192	61,296,954	93,053,147	26,179,476	6,313,455	21,447,396
Cleveland Municipal Electric Light Plant	138,592,090	138,592,090	0						
East St. Louis and Suburban Co.	126,969,671	45,628,830	81,340,841			51,135,904	(n) 26,606,208	38,285,107	10,942,452
Tri-City Railway & Light Co.	113,215,301	83,116,000	30,099,301	25,076,025	54,771,299	79,847,324	23,239,997	3,384,800	6,743,180
Union Electric Light & Power Co.	650,310,260	369,435,690	280,874,570	139,868,780	228,202,445	368,166,225		(o) 202,038,299	80,103,736
Northern States Power Co.	636,428,456	628,312,834	8,115,622	139,116,128	252,068,128	391,184,256	5,868,200	109,119,136	130,256,862
Mississippi River Power Co.	632,715,867	626,463,950	6,251,917	0	(p) 149,515,447	149,515,447	0	421,461,193	61,739,227
Milwaukee Electric Railway & Light Co.	553,624,392	497,742,193	55,882,199						
Kansas City Power & Light Co.	289,903,699	289,527,135	376,564	(q) 85,214,844	143,179,804	228,394,648	355,823	15,157,318	45,995,910
Minnesota Power & Light Co.	251,144,646	229,271,245	21,873,401	31,585,000	145,775,000	177,360,000	21,260,000	9,190,000	45,807,056
North West Utilities & East Wisc. Elec. Co.	203,997,334	150,798,086	53,199,248	(r) 15,141,024	(s) 18,805,773	33,946,797	0	140,232,789	29,817,748

Tri-City Railway & Light Co.	113,215,301	83,116,000	30,099,301	25,076,025	54,771,299	79,847,324	25,259,997	3,584,800	8,743,180	
Union Electric Light & Power Co.	650,310,260	369,435,690	280,874,570	139,668,780	228,297,445	368,166,225		(o) 202,038,299	80,105,736	
Northern States Power Co.	636,428,456	628,312,834	8,115,622	139,116,128	252,066,128	391,184,256	5,868,260	109,119,138	130,236,892	
Mississippi River Power Co.	632,715,867	626,463,930	6,251,917	0	149,515,447	149,515,447	0	421,461,193	61,739,227	
Milwaukee Electric Railway & Light Co.	553,624,392	497,742,193	55,882,199							
Kansas City Power & Light Co.	289,903,699	289,527,135	376,564	(q) 85,214,844	143,179,804	228,394,648	355,823	15,157,318	45,995,910	
Minnesota Power & Light Co.	251,144,646	229,271,245	21,873,401	31,585,000	145,775,000	177,360,000	21,260,000	9,190,000	45,807,056	
North West Utilities & East Wisc. Elec. Cos.	203,997,334	150,798,086	53,199,248	(r) 15,141,024	(s) 18,805,773	33,946,797	0	140,232,789	29,817,748	
Nebraska Power Co.	160,624,600	160,624,600	0	42,246,350	75,289,782	117,536,132	0	22,191,100	20,897,368	
Kansas Gas & Electric Co.	160,464,200	144,477,200	15,987,000	29,453,891	90,358,355	119,812,246	9,301,768	3,359,778	27,990,408	
Empire District Electric Co.	152,681,540	128,144,100	24,537,440	9,270,631	86,487,936	95,758,567	0	27,872,800	29,050,173	
East South Central States										
Alabama Power Co.	763,260,963	759,758,358	3,502,605	17,619,838	380,585,528	398,205,366	25,000,000	204,379,569	135,676,028	
Tennessee Electric Power Co.	460,097,505	456,993,605	3,103,900	14,407,115	180,966,282	195,373,397	14,042,880	187,122,610	63,558,618	
Birmingham Railway, Light & Power Co.	162,443,207	0	162,443,207	28,000,000	68,000,000	96,000,000	65,826,992	0	616,215	
West South Central States										
Fort Worth Power & Light Co.	240,662,700	240,656,700	6,000	16,158,114	58,484,772	74,642,886	0	150,129,994	15,889,820	
Texas Power & Light Co.	225,453,000	71,547,000	153,906,000	24,634,846	82,448,889	107,083,735	24,634,846	82,448,889	38,059,405	
New Orleans Public Service, Inc.	211,765,420	211,765,420	0	35,054,564	54,888,334	89,942,898	0	31,543,277	90,279,245	
Houston Lighting & Power Co.	129,318,120	129,318,120	0	24,196,270	83,215,567	107,411,837	2,702,975	146,223	19,057,085	
Dallas Power & Light Co.	105,400,728	55,221,297	50,179,431	33,061,312	27,354,213	60,415,525	32,369,728	14,308	12,601,167	
Mountain States										
Montana Power Co.	1,122,750,450	1,122,750,450	0	(t) 32,013,422	794,456,566	826,469,988	122,643,791	15,526,059	158,110,612	
Utah Power & Light Co.	621,977,000	621,427,000	550,000	55,432,507	418,738,811	474,171,318	52,037,474	857,450	94,910,758	
Idaho Power & Light Co.	222,590,000	210,883,000	11,707,000	76,964,493	82,060,580	159,025,073	4,892,978	3,029,879	55,642,070	
Public Service Co. of Colorado	145,302,874	70,780,880	74,521,994	62,239,957	47,611,669	109,851,626	0	8,178,914	27,272,334	
Colorado Power Co.	137,345,406	(u) 137,343,836	1,570	4,126,365	32,461,956	36,588,321	5,396,400	74,878,306	20,482,379	
Pacific States										
Pacific Gas & Electric Co.	1,725,619,492	1,580,875,158	144,744,334	178,045,791	599,284,313	777,330,104	255,776,769	163,604,487	528,908,132	
Southern California Edison Co.	1,548,896,120	(v) 1,464,255,747	84,640,373	98,679,400	740,420,044	839,099,444	318,130,559	21,740,900	(w) 369,925,217	
Great Western Power Co.	589,597,024	575,283,500	14,313,524	57,503,524	278,012,010	335,515,534	32,510,325	45,253,779	176,317,386	
Puget Sound Power & Light Co.	577,578,440	503,292,323	74,286,117				36,399,669	(x) 460,246,329	(y) 80,932,442	
San Joaquin Light & Power Corp.	465,458,706	465,403,480	55,226	42,020,476	205,765,988	247,786,464	4,615,158	129,469,200	83,587,884	
Los Angeles Bureau of Power and Light	426,337,964	251,076,510	175,261,454	131,849,070	208,004,404	339,853,474	0	2,905,984	83,578,506	
Washington Water Power Co.	413,240,900	407,226,900	6,014,000			209,354,661	70,346,064	58,131,132	75,409,043	
Portland Railway, Light & Power Co.	365,997,750	365,960,600	37,150	48,767,464	138,523,662	187,291,126	(z) 89,338,918	4,375,845	84,991,861	
Southern Sierras Power & Nevada-Calif. Power Cos.	219,653,900	206,510,850	13,143,050	6,845,353	144,661,495	151,506,848	0	6,961,544	61,185,508	
California-Oregon Power Co.	153,500,531	152,533,981	966,550	14,534,617	36,636,136	51,170,753	0	63,693,444	38,636,334	
Northwestern Electric Co.	152,702,800	131,266,300	21,436,500	19,025,378	99,673,520	118,698,898	0	596,930	33,406,972	
Tacoma Dept. of Light & Water	136,757,822	128,046,788	8,711,034	30,393,152	61,919,007	92,312,159	1,259,000	855,681	42,330,982	
Los Angeles Gas & Electric Corp.	127,357,201	126,691,871	665,330	66,223,338	39,513,607	105,736,945	0	80,414	21,539,842	
Pacific Power & Light Co.	116,676,395	93,363,865	23,312,530	17,070,392	42,447,964	59,518,356	0	26,136,680	31,021,359	
Seattle Dept. of Light and Water	115,431,550	114,372,800	1,058,750	47,628,800	28,602,115	76,230,915	2,818,780	6,520,645	29,861,210	
Totals for United States	44,258,638,877	39,373,114,797	4,885,524,080			24,968,660,007	4,593,967,893	6,325,127,445	7,469,623,517	
Canada										
Hydro-Electric Power Comm. of Ontario	2,906,519,819	2,707,054,322	199,465,497							
Shawinigan Water & Power Co.	1,667,397,876	1,199,867,676	467,530,200	0	1,147,573,236	1,147,573,236	0	371,252,714	148,571,926	
Montreal Light Heat & Power Consol.	1,089,099,507	836,626,229	252,473,278			(A) 1,040,000,000	49,099,507	0		
Ontario Power Co. of Niagara Falls	982,313,100	859,867,100	122,446,000	0	380,000,000	380,000,000	0	590,000,000	12,313,100	
City of Winnipeg Municipal System	164,609,860	164,609,860	0	89,142,519	20,001,326	109,143,845	0	17,842,155	37,623,860	
Western Power Co. of Canada	129,548,600	129,548,600	0	0	0	0	0	117,703,821	11,844,779	
Totals for Canada	6,939,488,762	5,897,573,787	1,041,914,975			2,676,717,081	49,099,507	1,096,798,690	210,353,665	
Electric Railways										
Interborough Rapid Transit Co.	960,340,481	960,315,120	25,361	0	1,007,669	1,007,669	(B) 829,640,392	306,620	129,380,800	
Chicago Surface Lines	576,457,370	0	576,457,370							
Williamsburgh Power Plant Corp.	449,827,266	449,515,391	311,875							
Philadelphia Rapid Transit Co.	383,313,078	154,646,570	228,666,508	0	0	0	(D) 383,313,078	0		
Boston Elevated Railways Co.	257,983,320	257,983,320	0							
Pennsylvania Railroad Co.	244,113,039	243,208,150	904,889	0	0	0	139,474,275	0	104,638,764	
Pacific Electric Railway	198,211,000	0	198,211,000							
New York Central Railroad Co.	163,895,940	163,843,440	52,500							
Twin City Rapid Transit Co.	146,605,919	104,771,490	41,834,429	0	0	0	(C) 146,605,919	0		
Kansas City Railways Co.	128,302,450	128,302,450	0	0	61,624	61,624	12,312,377	450,364	115,478,085	
Chicago, Milwaukee & St. Paul Ry. Co.	122,643,791	0	122,643,791							
Totals for Electric Railways	3,631,693,654	2,462,585,931	1,169,107,723		1,069,293	1,069,293	1,511,351,041	756,984	349,497,649	

Blank indicates that no report of distribution was received. (a) Includes 5,871,210 kw.-hr. sold for municipal street lighting. (b) Includes sales to railroads. (c) Includes 23,455,000 kw.-hr. generated by one of the subsidiary companies and used by it on its electric railway line. (d) Includes energy sold to electric railways. (e) Includes energy sold for street lighting. (f) Residences and small commercial houses under 5-kw. demand and street lighting. (g) Includes lighting of customers having 5-kw. demand or greater. (h) Includes 9,868,559 kw.-hr. sold for street lighting. (i) Does not include 54,853,045 kw.-hr. generated at Blue Island plant and prorated to the Commonwealth Edison Company. (j) Includes 224,185 kw.-hr. for lighting supplied by company in Commonwealth Edison territory. (k) Includes 61,777 kw.-hr. for power supplied by company in Commonwealth Edison territory. (l) Includes 4,426,399 kw.-hr. sold for municipal lighting. (m) Includes 2,442,570 kw.-hr. sold for municipal power. (n) Includes 17,198,039 kw.-hr. used by company's electric railways. (o) Includes sales to electric railways. (p) Company sells only at wholesale. (q) Includes 11,036,529 kw.-hr. sold for municipal lighting. (r) Includes 2,904,735 kw.-hr. sold for municipal lighting. (s) Includes 752,932 kw.-hr. sold for municipal power. (t) Includes energy sold for domestic heating. (u) Includes 1,710,150 kw.-hr. excess from customers in parallel. (v) Exclusive of 5,707,568 kw.-hr. used in generating stations. (w) Used in construction work, 29,052,224 kw.-hr.; used in other company operations, 2,187,710 kw.-hr.; used by company light, 679,152 kw.-hr.; used by company power, 492,137 kw.-hr.; transmission loss, 206,505,713 kw.-hr.; substation loss, 791,111 kw.-hr.; distribution loss, 130,217,170 kw.-hr. (x) Includes energy used for light and power and also that sold to other utilities. (y) Includes 2,307,940 kw.-hr. used by water, heat and gas departments of the company. (z) Includes 60,513,468 kw.-hr. used by company street and interurban railways. (A) Includes energy used in intra-company business and line losses. (B) Includes 650,836,662 kw.-hr. used by company third-rail traction system. (C) Includes line losses. (D) Includes line losses.

Standardize Equipment but Not Engineering

Manufacturers' Bids Lack Standardization Even as Regards Principal Characteristics of High-Tension Equipment

BY M. M. SAMUELS
J. G. White Engineering Corporation, New York, N. Y.

STANDARDIZATION, if not judiciously applied, often spells stagnation. If an attempt is successfully made to standardize a new art during the early stages of its development, it may result in hampering, if not altogether arresting, such development. And yet standardization of fundamentals is not only possible but necessary at the very inception of a new art, in order to make development possible and to avoid confusion.

Much has been said about the need of standardization in the secondary high-tension field, by which is meant the field comprising such apparatus as disconnecting switches, choke coils, etc., since the primary high-tension field, comprising transformers, oil circuit breakers, etc., is practically standardized in such a happy manner that it does not hamper conservative, progressive development. When specifying a transformer of certain voltage and certain kva. or an oil circuit breaker of certain voltage, certain amperage and certain rupturing capacity, the apparatus, whether purchased from one manufacturer or another, will give approximately the same service. Chaos, however, prevails in the secondary field of high-tension equipment, which is very unfortunate for the industry and would seem to call for some definite constructive action on the part of engineering societies, since it is apparently almost hopeless to expect the various manufacturers to get together on common ground and to agree on fundamentals. Competition seems to be too keen for such an arrangement at the present time.

For the same voltage rating the various manufacturers use insulators of widely different characteristics, both mechanically and electrically. On disconnecting switches there is a great variety of break distance, size of blade and phase spacing, and on choke coils there is an almost unbelievable difference in diameters, number of turns, length, etc. What the various manufacturers use as a basis for determining the various dimensions seems to be known only to them. A prospective purchaser recently asked thirteen different manufacturers to submit quotations on a number of 15,000-volt, 300-amp. gang-operated disconnecting switches and choke coils, specifying only voltage and amperage and requesting the various manufacturers to give detailed description of the proffered equipment. Table I gives a digest of the various quotations and lays bare the great confusion existing in the market. Dry flashover values of insulators vary from 70 kv. to 120 kv., or about 72 per cent; wet flashovers from 40 kv. to 90 kv., or approximately 125 per cent. The break distances vary from 10¼ in. to as high as 54 in., or approximately 425 per cent, and spacings between phases vary from 24 in. to 66 in., or 175 per cent. The diameters of choke coils vary from 4 in. to 15 in., or approximately 275 per cent and the number of turns varies from eleven to twenty-four, or approximately 118 per cent. The total price for a certain lot varies from $6,300 to $14,200, or 125 per cent.

This at once discloses an unhealthy and impossible state of affairs. It is obvious that when an engineer specifies merely voltages and amperages he does not know what he is going to get. While the big purchaser, who is in a position to scrutinize quotations carefully, will be able to discriminate intelligently between the various tenders, the small purchaser can easily become a victim of this intolerable state of affairs. Here standardization is not only possible but absolutely necessary. It may be that the N. E. L. A. or the A. I. E. E., or possibly the two together, can investigate this matter and bring out a specification covering the fundamental features of the equipment, so that when an engineer specifies a switch for certain voltage he will know that the insulators furnished with the switch will not be smaller than the then established standard, and he will likewise know that if his special requirements call for a different insulator, it will be necessary to consider it a special case.

From the above it is no doubt clear what is meant by the term "standardizing on fundamentals." In this particular case a standard A. I. E. E. or N. E. L. A. specification would give the minimum dimensions and flashover values of insulators to be used on switches, etc., of certain voltages, the minimum break distances and minimum spacings. For choke coils it would give the minimum diameter, minimum number of turns, minimum length and possibly some reference to reactance. (Some manufacturers are obviously unaware of the fact that a choke coil is supposed to have some reactance value and does not merely have to look pretty.)

Important as this standardization is, it should not go too far. The field of switch design should be left open for fair competition and for new ideas. The industry is virtually in its infancy, and there are obviously many manufacturers, and also many engineers, who are misfits or incompetents. But there also are those manufacturers who are using a great deal of skill and are steadily improving their product, and there are

TABLE I—QUOTATIONS ON DISCONNECTING SWITCHES AND CHOKE COILS WITH ONLY VOLTAGE AND AMPERAGE SPECIFIED

(Showing wide diversity of characteristics of equipment proposed to meet given conditions)

			Insulators			Switches		Choke Coils		Total Price
			Flashover							
Quotation No.	Manufacturer	Catalog No.	Dry Kv.	Wet Kv.	Insulators per Phase	Break Distance, In.	Distance Between Phases, In.	Diameter, In.	No. of Turns	
1	.....	.....	70	50	3	12	42	6½	14	$11,011
2	O. B.	12,546	100	60	3	12	30	...	...	10,600
3	O. B.	12,546	100	60	3	10½	24	9	24	8,090
4	.....	.....	...	...	3	54	66	9	14	14,200
5	Locke	5,155	120	90	2	24	36	...	...	7,120
6	Locke	6,511	80	55	3	12	30	4	14	8,100
7	.....	.....	93	55	3	16	48	13	14	11,200
8	O. B.	12,546	100	60	3	11	24	12	14	8,340
9	Faradoid	2–22	105	65	2	24	30	15	11	8,030
10	Faradoid	2–15	80	50	2	24	30	15	11	7,550
11	J. D.	A-254	80	40	2	24	30	15	11	8,040
12	Pinco	69	100	65	2	30	24	8	10	7,000
13	O. B.	12,852	86	40	3	18	24	9	16	6,300

TABLE II—QUOTATIONS ON COMPLETE SUBSTATION

(Showing opportunity for good engineering in design and that standardized design of composite structures is not advisable)

Quotation No.	Total Approximate Area of Required Site, Sq.Ft.	Grade of Quality of Apparatus	Design of Steel-Work	General Arrangement Design	Total Price
1	5,020	B	Satisfactory	Clumsy	$25,414
2	4,900	C	Very good	Clumsy	25,400
3	4,800	D	Good	Fair	16,200
4	6,600	E	Poor	Awkward	15,500
5	2,500	A	Good	Very good	14,800

many engineers with new ideas resulting mostly from trouble experienced with old ideas. Switch design and inventive spirit should not in any way be hampered by standardization. The field of station design, particularly, should not be allowed to fall into lethargy. This, in my opinion, should be left entirely to the engineer and should be influenced as little as possible by the manufacturer. A prospective purchaser recently requested tenders from various manufacturers on complete outdoor substations exclusive of transformers, oil circuit breakers and lightning arresters, but inclusive of steelwork, bus work, disconnecting switches and choke coils. The remarkable results of the investigation of various bids received are contained in Table II, from which it may be seen that the required ground areas vary from 2,500 sq.ft. to 6,600 sq.ft., or approximately 163 per cent, and that the bid requiring the smallest ground area was the lowest in dollars, in spite of the fact that the switches of that particular manufacturer are among the most expensive on the market at the present time.

This remarkable result was due to skillful station design, a field in which most manufacturers do not show any great amount of proficiency. Whereas Table I is undoubtedly a just outcry in favor of standardization of fundamental dimensions of apparatus, Table II is an equally strong argument against any standardization of station design and a warning to those operating companies that have been led into the false economy of a saving in engineering expense by standardizing on station designs of one or another manufacturer. With competent station design it is obviously possible to obtain a minimum station cost even with a maximum expenditure on good equipment.

"Gas" Trucks in Central-Station Service

Survey of Representative Practices in All Parts of the Country —Trend Toward Standardization Is Manifest—Opinions of Operators—Data on Costs, Performances, Types and Uses

THIS is the first of a series of articles dealing with transportation equipment used by light and power companies. The data and comments were obtained from eighteen companies in all parts of the United States. These companies are of various sizes and operate in both city and country districts, so that their service conditions are variable. The other articles to be published will deal with the use of electric vehicles, gasoline passenger vehicles and special construction and maintenance equipment.

THE transportation of men and materials in order to provide, extend and maintain energy and merchandising service has developed into an important activity of light and power companies. Power-operated construction and maintenance equipment has been widely adopted for reducing costs, increasing the rate of construction and eliminating the necessity for arduous labor by employees.

As this activity has developed a very large variety and quantity of transportation equipment has been found necessary and many methods for establishing an operating and cost accounting system have been put into effect. With the present development attempts are being made to standardize on types of vehicles for each service requirement and on accounting systems best adapted for a transportation department. In order to obtain representative data and opinions, several companies were asked to supply information in the hope that a study of the material would bring out facts of value to the industry and make available to transportation departments the experience of different properties and the suggestions based upon it.

The replies from eighteen companies show that transportation departments have become large and important and that a rather unorganized condition exists as regards the choice of vehicles for similar service requirements, the operating organization best suited to the transportation needs and the record system best adapted for determining performances and costs. Gasoline passenger cars are used in large numbers for the transportation of employees, patrol duties and light maintenance and service operations; gasoline and electric trucks are found indispensable for construction and maintenance work, for servicing customers and for the hauling of supplies and materials; tractors, trailers and special equipments are found useful for special applications such as digging, trenching, cable pulling and overhead and underground construction.

A very large number of gasoline trucks are used by central-station properties. Their general field of application lies in services requiring speed, power and long hauls. They are adapted to virtually all services not affected by traffic speed limits, frequent starting and stopping or special requirements or conditions. For the light trucks the greatest asset is speed of movement in getting men or materials from point to point, and the heavy trucks are particularly useful for duties requiring much power and for long, heavy hauls of men or materials.

In general ½-ton to 1-ton light trucks are used for patrol, service extensions, trouble and meter work; 1-ton to 2-ton trucks for hauling materials and supplies and for light construction work, while 2-ton to 5-ton trucks are used for heavy haulage and construction work. Trailers and special devices on bodies are used freely, but the type depends upon the requirements of the particular service. High-speed trucks are used for emergency trouble or repair work.

Some details of truck uses can be listed, such as haulage of coal, ashes, dirt, small and large transformers and other apparatus, freight and express; carrying supplies from warehouses to stores, to construction jobs and to substations; running service taps, setting meters, delivering appliances, patrol work, line maintenance work and line construction work both overhead and underground. Trucks are also indispensable for emergency trouble work, in power station yards, for cable pulling, for street-lighting maintenance and

TABLE I—GAS TRUCKS USED BY EIGHTEEN COMPANIES

Capacity, Tons	Number of Cars	Total
¼	259 Ford	259
½	140 Ford, 34 Dodge, 10 Chevrolet, 13 Reo, 6 Buick	203
¾	149 Dodge, 30 White, 6 Dodge-Graham, 4 Ford, 1 Reo	190
1	171 Ford, 60 Reo, 34 R.M.C., 18 Chevrolet, 21 White, 7 Oldsmobile, 1 Larrabee, 2 International, 2 Studebaker, 2 United Motors, 4 Miscellaneous, 6 Vim	328
1¼	23 Garford, 18 Dodge	41
1½	15 Graham, 12 Mack, 6 Federal, 6 Dodge-Graham, 2 Dodge, 1 Moreland, 1 Kelley, 2 White	45
2	117 White, 92 G.M.C., 25 Pierce-Arrow, 32 Packard, 17 Mack, 8 Dodge-Graham, 1 Moreland, 3 American LaFrance, 4 International, 4 Republic, 2 Reo, 3 Miscellaneous	308
2½	22 Mack, 6 Larrabee, 2 Moreland, 1 Fageol	31
3	10 White, 2 F.W.D., 1 Packard	13
3½	51 Packard, 17 Mack, 8 Pierce-Arrow, 4 Federal, 2 White, 1 G.M.C., 1 Duplex	84
4	1 Moreland	1
5	19 White, 7 G.M.C. 2 Mack	28
Total		1,531

for miscellaneous jobs requiring the movement of men or materials. High-speed trucks are demanded for emergency and patrol work, light trucks for patrol and construction work where bad roads are encountered, and heavy trucks where heavy hauling and construction are carried on.

A cross-section of opinion about gasoline trucks affords opportunity for comparisons and for determining methods of approach to bring about better conditions. The following pertinent opinions by men in charge of truck transportation show the ideas and practices of several properties:

1. "Costs are valuable only when they are kept in detail so that all elements can be considered. Traffic conditions, and especially congestion, make it imperative to have careful drivers and to maintain the brakes in good condition. The commendable practice is to standardize on the best vehicles manufactured."

2. "Experience shows that it is necessary to standardize trucks. We have been trying to standardize on Reo and White trucks and to standardize on truck bodies and truck capacities for each class of work."

3. "Our cost records are not detailed or very accurate. We maintain a replacement reserve based on average life and first cost and credit to this account a fixed amount each month. We also keep a maintenance reserve and credit this account, on a mileage basis, predetermined costs. All fuel, repairs and garage charges are charged against this account. We are standardizing on Fords for light work and on Whites for heavier work."

4. "We keep detailed and accurate cost records of all expense items except insurance. Each car has a separate record sheet which shows mileage, miles per gallon of gasoline and oil, and other expense items. In some cases, however, a flat fixed charge is used in the accounting instead of the detailed costs."

5. "We keep costs on the basis of all items but wages of driver and interest on investment. Costs are modified greatly by weather, road and service conditions."

6. "Our costs are based on average mileage, and depreciation is also only correctly used when computed on a mileage basis."

7. "Our system is widely scattered with extremes in weather and terrain. It is difficult to standardize under these conditions."

8. "Our experience with two other makes of trucks has led us to conclude that White trucks are the least expensive. We find trailers very useful."

9. "Ease in obtaining repair parts is a deciding influence in deciding which make of truck to use. The most important item is the mileage per gallon of gasoline."

10. "We keep costs under divisions of repairs, miscellaneous and fuel. Miscellaneous costs include garage charges, insurance, licenses, etc."

11. "We have made some changes which have prolonged the life of Ford trucks in our service very materially. Our heavier work requires Dodge trucks. Our records of cost are not very detailed, and service conditions largely govern the type of truck which it is best to use."

12. "We have standardized on three classes—Dodges for light work because of their low cost and economical operation, White trucks for intermediate loads, and Mack trucks for the heavy work."

13. "Costs are kept on a monthly basis. Three charges make up the cost per mile—(1) tires, oil, gasoline, supplies and part of garage time plus a portion of the overhead, (2) fixed charges including interest at 6 per cent on the investment, depreciation, taxes, insurance, registration, (3) 5 per cent of the

TABLE II—COMPARATIVE COSTS OF EQUIPMENT BASED ON 1,000 MILES PER MONTH

	Rating in Tons				
	¼	1	1½	2	5
Mileage	1,000	1,000	1,000	1,000	1,000
Gasoline (gal.)	93.40	120.60	192.9	227.40	269.00
First cost of car	$593.36	$683.29	$3,220.80	$4,590.00	$6,400.00
Salvage value*	75.00	90.00	400.00	500.00	750.00
Net cost of car	518.36	593.29	2,820.80	4,090.00	5,650.00
Operating costs:					
Tires	11.28	22.72	32.40	50.20	36.00
Repairs—running	40.00	45.00	55.00	60.00	72.00
Repairs—overhaul	17.00	20.00	33.00	40.00	48.00
Cleaning and care	11.29	11.29	11.29	11.29	11.29
Alcohol, oil, waste	2.97	2.97	2.97	2.97	2.97
Gasoline at 20 cents	18.68	24.12	38.58	45.48	53.80
Sundries	1.07	1.61	7.95	2.89	5.59
Cost per mile	0.1023	0.1277	0.1812	0.2128	0.2297
Fixed Costs:					
Office salaries	6.68	6.68	6.68	6.68	6.68
Office expenses	1.43	1.43	1.43	1.43	1.43
Garage wages	12.03	12.03	12.03	12.03	12.03
Garage expenses	5.30	5.30	5.30	5.30	5.30
Garage maintenance	3.39	3.39	3.39	3.39	3.39
Depreciation	8.64	9.89	47.01	68.17	94.17
Cost per mile	0.0375	0.0387	0.0758	0.0970	0.1230
Overhead Costs:					
Interest, at 6 per cent	2.97	3.42	16.10	22.95	32.00
Insurance—fire and theft	9.25	.29	1.27	1.76	1.51
Insurance—liability	12.08	12.08	12.75	13.50	14.25
Cost per mile	0.0153	0.0158	0.0301	0.0382	0.0488
Total cost per mile	0.1551	0.1822	0.2872	0.3480	0.4014

* Based on five-year life.

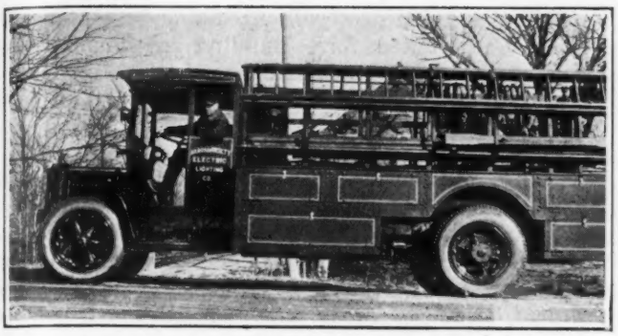


FIG. 1—A 2-TON TRUCK USED IN CONSTRUCTION WORK

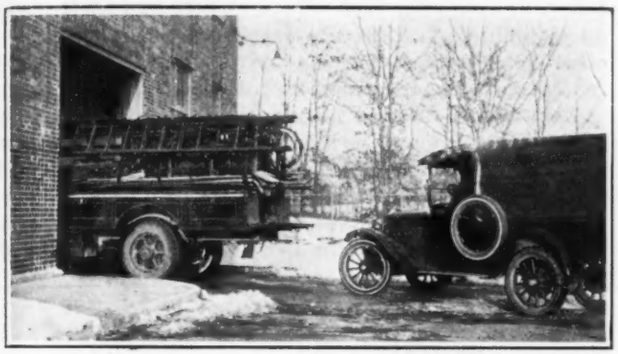


FIG. 2—A LARGE TRUCK FOR HIGH-TENSION LINE CONSTRUCTION AND REPAIR, AND A LIGHT TRUCK FOR MESSENGER AND MAIL SERVICE

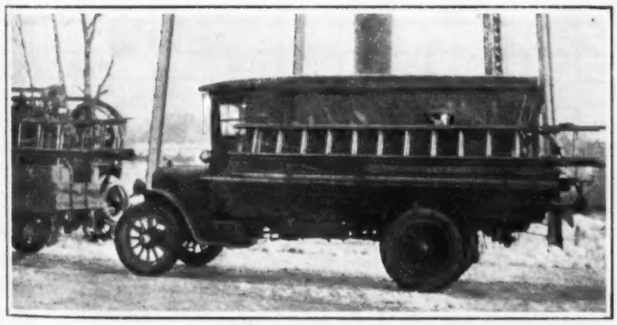


FIG. 3—TRUCK FOR LINE TAPS AND SERVICE WORK

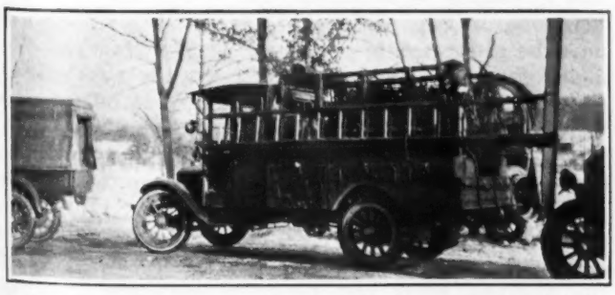


FIG. 4—A TRUCK EQUIPPED FOR LIGHT CONSTRUCTION WORK

sum of (1) and (2) to cover rent, supervision, clerical work, etc. We are standardizing on Dodge trucks."

14. "Because we operate in a city only and have level and fairly good streets with frequent stops we have adopted electric trucks for transportation service. We believe the electric truck is the best form of vehicle for urban service. It is efficient, economical and reliable."

15. "We are standardizing on Dodges for light work and believe that electric trucks are less expensive than gasoline trucks when vehicles of two tons or more are utilized."

16. "Ford trucks are splendid for light work; for heavier work we are standardizing on White trucks."

17. "The company's experience tends to show that Dodge trucks are most economical for the work required."

18. "The life of a car is based almost entirely on mileage, and this is the only logical basis for charging depreciation. Second-hand values are determined by the year and the model to a great extent, but for central-station purposes this element need not be considered, because the mechanical condition of a car is the important consideration."

Costs of Operation and Length of Life

No general statements can be made as to the cost or the length of life of any make or rating of truck. Trucks of the same capacity are recorded as having lengths of life between such extremes as three and ten years. This comes about because of the differences in service use, the differences in terrain upon which the trucks are operated, differences in climatic and road conditions and in operating skill and record systems used. Also, the variation in the fixation of the period at which it is advisable to sell the truck affects the figures given.

Costs are even more a matter of individual properties. As a rule there is a trend toward keeping accurate and detailed cost records for each truck sufficient to obtain data for determining types upon which to standardize. However, many variables needed to determine total costs are omitted by some companies which are used by others—in particular, costs involving drivers' wages, garage charges, investment and overhead. No general agreement exists as to the method of fixing depreciation charges, salvage values or of allocating overhead and fixed costs. The cost of oil, gasoline, tires and repairs is usually kept for each unit, but these costs become a smaller proportion to the total cost as the size and first cost of the trucks increase.

Some companies keep records on a per mile basis determined from each unit's operating record. Others base costs on the average mileage record of each type and rating of truck. Other units, such as miles per month or per year, are also used in establishing cost-accounting systems. Table IV shows data giving the extreme ranges of life and cost as sent in by the eighteen properties.

Since there is very little agreement as to the items which should be recorded in order to determine the service and economic performance of trucks, and since many companies keep operating costs only and even these in a more or less sketchy manner, a study of practices shows the following data to be necessary for all vehicles in a transportation department if comparative performances and complete costs are to be recorded. In addition, a suggested method of allocating the costs is given:

1. A record of car mileage on a monthly and yearly basis.

2. A record of the service application of each vehicle and the territory in which it is operated.

3. The actual cost of the vehicle equipped and delivered ready for service.

4. The salvage value of the vehicle, based on the end of its useful life in terms of mileage and the money for which it can be sold.

TABLE III—COST RECORD OF ONE COMPANY, IN CENTS PER MILE

Type	Operating and Repairs	Garage Insurance, Licenses, Etc.	Fuel	Total Cost	Average Miles per Year	Miles per Gallon of Gas	Average Life
Ford delivery	4.76	1.10	2.17	8.03	10,375	15.2	5
Other delivery	9.86	2.39	2.75	15.00	5,440	10.8	13
Light trucks	8.13	1.91	3.43	13.47	8,000	9.6	6½
½-ton trucks	5.47	3.18	5.01	13.66	6,000	6.9	4½
¾-ton and 3½-ton trucks	11.84	3.68	9.02	24.54	5,700	3.6	7
Averages	6.19	1.62	3.06	10.87	8,300	11.8	7

5. The net cost of each vehicle as an investment equals first cost minus salvage value. This cost is the basis investment figure for prorating fixed and overhead costs on each vehicle.

6. Operating costs should be subdivided into items which vary with service use and should be reduced to a per mile unit as follows: (a) Tires; (b) routine operating repairs; (c) complete overhaul; (d) supplies such as alcohol, oil, waste; (e) gasoline—gallons, cost per gallon and cost per mile; (f) miscellaneous items of cost required to service vehicle in garage, battery charging, cleaning, etc.

7. Fixed costs are based on the total investment in the transportation department, including organization, buildings and vehicles. These costs should be prorated between vehicles on a net cost basis for some items, while other costs should be divided equally between vehicles. The following subdivisions are suggested:

(a) Supervision includes salaries of office and executive organization charged to transportation department. Prorate on vehicles on a net cost per vehicle basis.

(b) General expenses include office and organization operating expenses for routine supplies and building services. Prorate on basis of net costs.

(c) Wages: (1) Garage wages for attendants, guards, mechanics and laborers excluding drivers; (2) wages of drivers. Prorate (1) on basis of net costs and make specific charges for each vehicle for (2).

(d) Garage expenses—all, fixed and operating, not otherwise accounted for. Building investment, fixed charges, light, heat, maintenance and depreciation.

(e) Car depreciation should be based on the life of each vehicle determined on a mileage basis and applied as a unit cost per mile.

(f) Interest and taxes. Building and vehicle investment should carry an interest charge, a general insurance charge and a tax charge. The insurance and taxes should not include those items carried on each vehicle. The general interest and overhead charges should be prorated between vehicles on the basis of net cost per vehicle and then reduced to a mileage basis.

(g) Vehicle overhead charges should consist of the following items for each vehicle: Fire and theft insurance, liability insurance, vehicle tax, license fee and other vehicle fixed charges, including license of driver for each vehicle if required.

As a result of the information obtained, the only general conclusion to be made is that all properties have come to realize that the systematic transportation of men and materials is a very important item in their business, well deserving of executive attention, and have made progress toward the most economical solution of the problem. Although conditions are still rather chaotic, there is a decided tendency toward standardization in vehicle classes, and the most potent way to secure this result is to introduce cost-accounting systems and operating records that will give a true indication of vehicle performance.

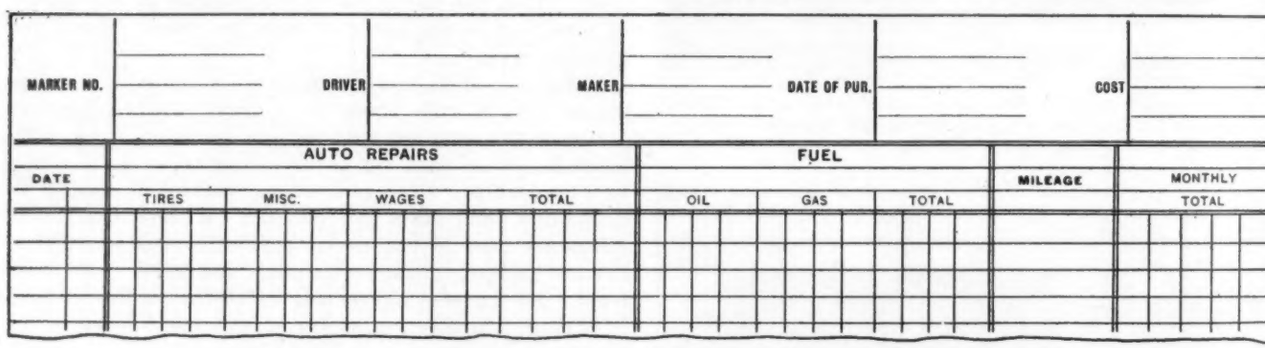


FIG. 5—FORM OF CARD USED BY ONE COMPANY FOR RECORDS OF EACH VEHICLE

In one or two sections of the country associations have been formed by heads of utility transportation departments to study co-operatively the problems of transportation, and these agencies seem to offer a good and direct avenue of approach toward better conditions. The gasoline trucks have a place in the transportation department of every organization and form the greatest proportion of the vehicles used at present. But much study must yet be given to the transportation question and many more data are needed before the place of the gasoline truck can be fixed definitely relatively with the place of electric trucks and passenger cars. Even decisive data on the relative economic value of expensive and inexpensive light trucks for central-station service are lacking, and a decided difference of opinion exists between the heads of the transportation departments of different utilities.

For heavy construction work and heavy hauling the best grade of gasoline truck should, in the opinion of all commentators, be purchased. This practice will result both in more economical operation and in more satisfactory and reliable service.

TABLE IV—LENGTH OF LIFE AND COSTS PER MILE OF GAS TRUCKS

Rating	Make	Life Years		Cost per Mile, Cents	
		Minimum	Maximum	Minimum	Maximum
¼	Ford	2	6	10.25	12.70
½	Ford	2	8	10.50	16.30
½	Dodge	4	6	10.5	13.00
½	Dodge	4	8	7.0	10.50
1	Ford	2	5	8.3	16.40
1	White	5	10	13.8	41.20
1	White	6	10	18.0	22.00
2	White	5	10	13.0	33.00
2	G.M.C.	5	10	13.0	30.00
2	Mack	5	10	13.0	28.00
5	White	5	10	20.0	46.40

Letters from Our Readers

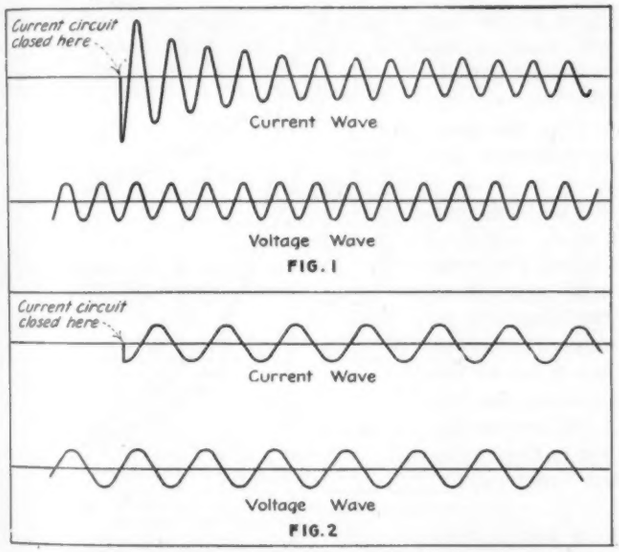
A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Errors in Relay Settings Due to Phantom Load

To the Editors of the ELECTRICAL WORLD:

I have read William S. Schmidt's interesting article on the above topic in the March 15 number of the ELECTRICAL WORLD, and I agree with his conclusions. However, it contains one minor point to which I would like to take exception.

Mr. Schmidt has based his calculations of errors in relay setting upon the results obtained with lamp load. What I would like to bring out is the fact that a lamp load is not the proper kind of load to use in relay setting, because, if tungsten lamps are used, the relays will be set too slow; in other words, they will operate faster during test than under actual operating



TRANSIENT CURRENT CONDITIONS AFFECT RELAY OPERATION

Fig. 1—With tungsten lamps. Fig. 2—With non-inductive resistance.

conditions. This is due to the high temperature coefficient of resistance of tungsten lamps. Fig. 1 is a reproduction from an actual oscillogram showing the magnitudes of currents in the relay circuit immediately after the circuit is closed when test current is controlled by a tungsten-lamp load. Owing to the initial inrush of current the relay will operate faster than if the steady value of current, as determined by an ammeter, were applied to it. The converse will be true if carbon lamps are used, because in this case the current will be slow in building up to its steady value.

Accordingly, the errors attributed in Mr. Schmidt's article to the use of non-inductive resistance units should have been in reality charged against the use of the lamp load. It is also apparent from the results given by Mr. Schmidt and the above remarks that Mr. Schmidt must have used tungsten lamps in his tests.

The use of non-inductive resistance units will, of course, as brought out by Mr. Schmidt, result in correct relay setting, because the current will build up to its steady value immediately upon the closing of the circuit, as shown in Fig. 2, which is a reproduction from an actual oscillogram.

The object of this communication is merely to bring out the fact that a lamp load will not result in correct relay setting, but will introduce errors of the order shown in Mr. Schmidt's article, which are there erroneously charged against the resistance load.

Cooper Union,
New York, N. Y. A. F. HAMDI,
Instructor in Electrical Engineering.

Need for Public Education on What Constitutes a Fair Rate of Return

To the Editors of the ELECTRICAL WORLD:

In a recent number of the ELECTRICAL WORLD containing an article about electric light and power securities as investments the following sentence appeared:

"Electric light and power securities have attained to such a high plane as sound investments that the industry should be able to finance these extensions at a yield under 6½ per cent, and the stronger companies will without doubt be able to borrow at a rate under 6 per cent."

While the use of the word "yield" in the above quotation and the context in which it appears might indicate that the rate per cent used had reference only to well-secured first mortgage loans and not to the average rate of return on capital invested in the electric light and power industry, nevertheless it seems to me that there is serious danger in speaking of the yield on this particular class of securities without qualifying it by specific reference to the higher average rate of return that, as we all know, is in fact necessary for sound financing. The public generally has even yet, in spite of all the education that the financial managers of electric utilities have been able to accomplish, a very hazy notion about what is meant by the rate of return on invested capital, and altogether too large a section of it is inclined to feel rather resentful if investors in public utilities receive more than savings bank interest, regardless of the nature of their security or of the risk involved. Public service commissions, too, and even the statutes of some of our more political states, tend to fix rates on a basis that will permit an average rate of return on all invested capital of no more than the legal maximum interest rate. Of course, this makes it almost impossible to create a sound financial structure through the issue of the proper proportion of junior securities and stock representing owners' equity.

While recognizing that the article in the ELECTRICAL WORLD was primarily intended for informed readers who would not misinterpret the sentence above quoted, I yet fear that such a statement is subject to dangerous misuse. Municipal corporation counsel are too frequently without knowledge of economics or finance, and sometimes politicians who have such knowledge nevertheless take a position which they think will be popular even though they know it is not sound. Such men might quote the ELECTRICAL WORLD in support of a contention for an impossibly low average rate of return to public utility investors.

We are not yet free from the danger of public ownership of public utilities, with all the weakness and inefficiency inherent in such a policy. Owners of public utilities may yet be forced to sell out at a heavy sacrifice to municipal corporations or other governmental agencies, unless they succeed in educating the public to a more just appreciation of the facts and thus check the present tendency on the part of regulatory commissions to find the "fair rate of return" is less than is actually required by sound economics. H. C. HOPSON.

New York, N. Y.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Three-Phase Transformers Supplying 220-Volt and 110-Volt Loads

By V. T. Mavity
Consulting Electrical Engineer, Indianapolis, Ind.

FOR supplying balanced three-phase power to both a 220-volt and a 110-volt circuit the arrangement shown in Fig. 1 is often used. Being faced with the necessity of loading a bank of transformers so connected the writer has made a study to determine the current and power output in the two halves of each transformer for different loads and power factors on the 110-volt and 220-volt circuits. In every case, as is natural to expect, the best economy is had by putting as much of the load as possible on the 220-volt circuit.

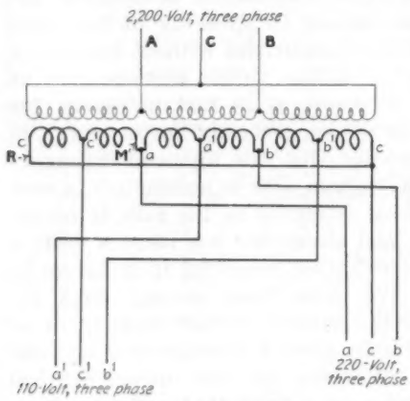
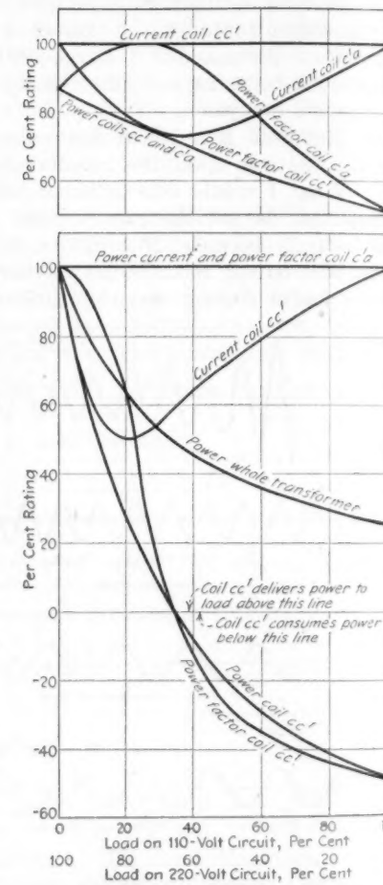


FIG. 1—THREE TRANSFORMERS SUPPLYING 220-VOLT AND 110-VOLT LOADS

The current, I_a, for example, which is the line current to the 220-volt load, is the vector sum of its two components I_{ca} and I_{ba} (see Figs. 2 and 3). Also $I_{c'}$, which is the line current to the 110-volt load, is the vector sum of its two components $I_{a'c'}$ and $I_{b'c'}$. In order not to complicate the diagrams, only the components of the line currents are shown.

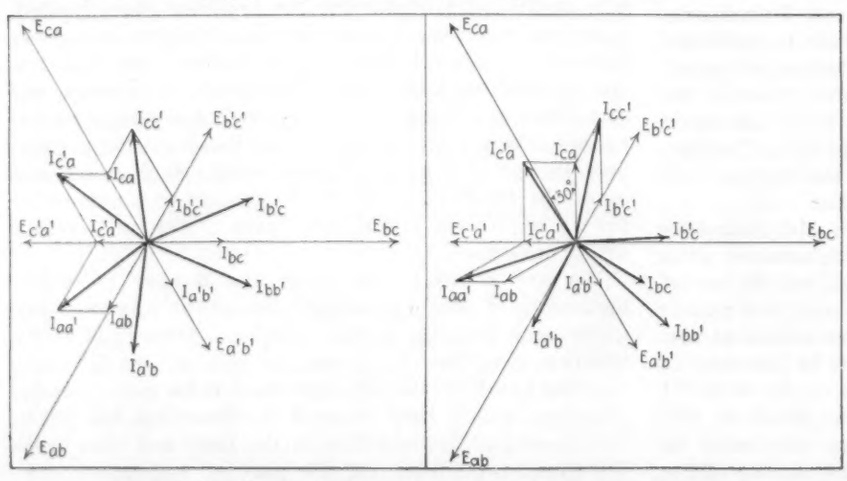
The total current in the coil cc' is the vector sum of I_{ca} and $I_{b'c'}$, and the total current in coil $c'a$ is the vector sum of I_{ca} and $I_{c'a'}$; these totals are shown on the diagrams as $I_{cc'}$ and $I_{c'a}$ respectively. The power factor of coil cc' is then given by the cosine of the angle between the two vectors $E_{cc'}$ and $I_{cc'}$. Likewise the power factor of coil $c'a$ is the cosine of the angle between vectors $E_{c'a}$ and $I_{c'a}$.

The curves of Fig. 4 and 5 need no further explanation except to say that for each of the two cases shown the total load received by the 110-volt and by the 220-volt circuit is the maximum possible without exceeding the current rating in one of the transformer coils. For balanced loads all three transformers will be loaded alike so that curves for coil $c'a$ are correct for coils $a'b$ and $b'c$ and curves for coil cc' are correct for coils aa' and bb'.



FIGS. 4 AND 5—DIVERSION OF LOADS IN THREE-PHASE TRANSFORMERS

Fig. 4—The power factor of the 110-volt load is 0.50 lagging while that of the 220-volt load is unity. Fig. 5—The power factor of the 110-volt load is unity while that of the 220-volt load is 0.866 lagging.



FIGS. 2 AND 3—CURRENT ANALYSIS OF TRANSFORMER LOADING

Fig. 2—Vector diagram for unity power factor in both circuits. Fig. 3—Vector diagram for unity power factor in 110-volt circuit and 30 deg. lag in 220-volt circuit.

Care must be taken not unwittingly to overload at least half of each transformer. The best way to prevent this is to measure the current in each coil by placing ammeters in the circuit at the points R and M (Fig. 1).

If it is further desired to supply 110 volts single-phase for lighting in addition to the three-phase load, it may be done by connecting the lighting circuit directly across coil $c'a$. For example, from Fig. 4, when 73

per cent of the total three-phase load goes to the 220-volt circuit, the power factor of coil *c'a* is unity, and lighting load up to 25 per cent of the rating of coil *c'a* may be supplied from that coil. If it were attempted to put the lighting load on coil *cc'*, it would overload the coil.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Pole-Type Transformers for Distribution

STANDARD pole-type distribution transformers shall be used as follows:

(a) On 2,300-volt and 4,000-volt circuits transformers having a rating of 2,300/230/115 volts shall be used. Large transformers with a secondary rating of 460/230 volts may be used when 460-volt service is required.

(b) On 6,900-volt and 12,000-volt circuits transformers having a normal rating of 6,900/230/115 with one 4½ per cent and one 9 per cent full capacity tap, giving the primary voltages 6,900, 6,585, 6,275 and 5,960, shall be used, except that 460-volt secondaries shall be obtained when necessary. Transformers having a rating of 6,900/2,300 volts, with taps for 7,200, 6,900, 6,585 and 6,275 volts, shall be used when 2,300-volt service is required.

Location.—Transformers shall be located as nearly as possible at the center of the load to be supplied by them and shall be so spaced that the secondary line drop shall be about 3 per cent. No transformer shall be placed on any buckarm pole, corner pole or pole carrying a street light unless with the prior approval of the distribution engineer, but should be mounted on good heavy poles in straight sections of the line. No transformer shall be mounted on any pole carrying high-tension (over 15,000 volts) wires, even if it is necessary to set an extra pole a span away from the line to avoid doing so.

Banking Secondaries. — In general, single-phase distribution transformers shall not be banked on the secondary side. However, in districts where the load is heavy and the transformers near together, as in business districts, transformers may be banked. In all such cases the following rules shall apply:

(a) All banked transformers shall have fuses installed in the secondary leads, as shown in Fig. 39A. These fuses shall be in accordance with the table shown in the illustration, which is based on 300 per cent transformer capacity. The neutral lead of three-wire 230/115-volt secondary circuits shall never be fused.

(b) Not less than three transformers shall be banked together in any case. Three transformers may be banked if all three are the same size. Four or more transformers may be banked, but in no case shall adjacent transformers vary more than one standard size. Each banked transformer must have one adjacent transformer equal or greater in size than itself.

(c) All transformers in a bank must, of course, be fed from the same primary phase.

Except upon approval of the distribution engineer polyphase transformer installations shall not be banked, nor shall single transformers of a polyphase installation be banked with other single-phase transformers.

Installation.—Approved methods of installing transformers are given in Table XIV. A single arm shall be used for mounting all single transformers up to 1,300 lb. (installed weight). This arm shall be attached to the pole by one ⅝-in. through bolt with a 4-in. x 4-in. galvanized washer under the head and nut of the bolt. Double arms shall be used for all single-pole installations of two or three transformers regardless of the size of the transformers. In general, all transformers up to three of 460 lb. (installed weight) each shall be hung on one pole.

All installations heavier than the above shall be mounted on platforms. The following kinds of timber may be used for beam material, preference being given in the order named: fir, long-leaf yellow pine, chestnut and white oak.

The braces of arms from which transformers hang shall be attached

TABLE XIII—FUSE SIZES FOR TRANSFORMER PRIMARY CUT-OUTS

For A and B see Fig. 39 B, C and D for connection requiring this size fuse. P—Plug-type cut-out. T—100-amp. expulsion-type cut-out. S—200-amp. expulsion-type cut-out. String fuse wire shall be used in plug-type cut-outs. Standard link fuses shall always be used in cut-outs containing link holders. Use standard fuse puller for handling expulsion-type cut-outs.

Transformer Size, Kva.	Size of Fuse in Amperes 2,300-Volt Transformers A		2,300-Volt Transformers B		6,900-Volt Transformers A		6,900-Volt Transformers B	
1	2	P	3	P				
1½	2	P	3	P				
3	5	P	8	P	2	T	3	T
5	8	P	10	P	3	T	5	T
7½	10	P	20	P	3	T	5	T
10	15	P	25	P	5	T	8	T
15	20	P	40	P	8	T	15	T
25	40	P	60	T	15	T	20	T
37½	50	T	90	T	20	T	30	T
50	70	T	100	T	25	T	40	T
75	100	T	175	S	40	T	60	T
100	125	S	200	S	50	T	80	T

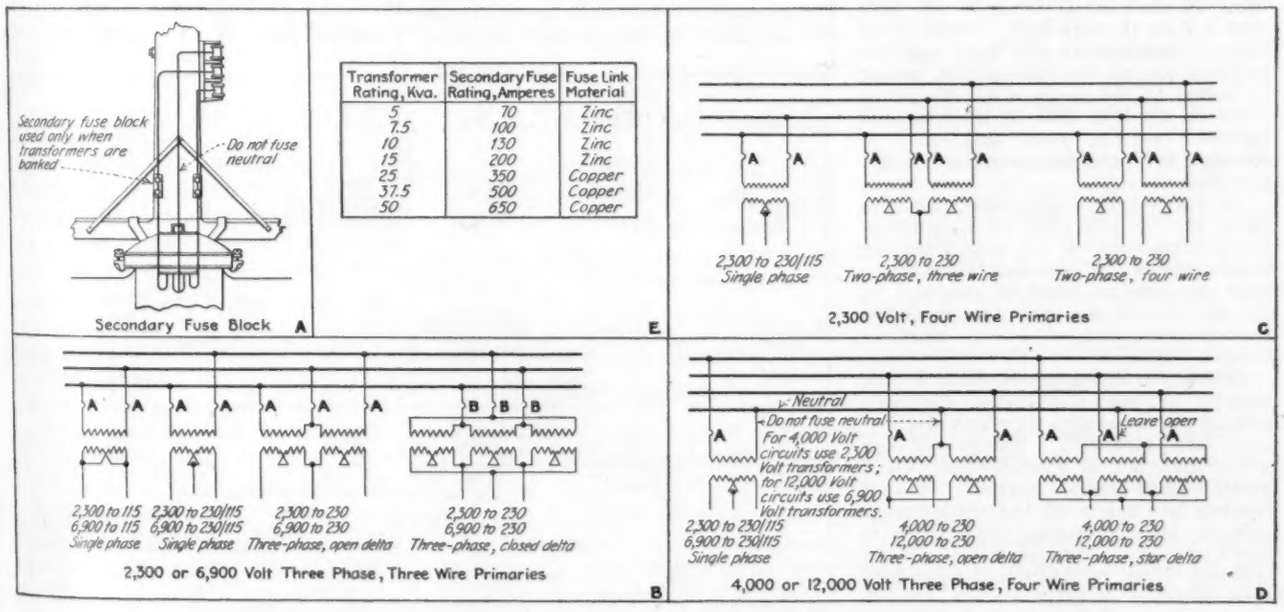

Secondary fuse block used only when transformers are banked
Do not fuse neutral
Secondary Fuse Block A
Transformer Rating, Kva. | Secondary Fuse Rating, Amperes | Fuse Link Material
5 | 70 | Zinc
7.5 | 100 | Zinc
10 | 130 | Zinc
15 | 200 | Zinc
25 | 350 | Copper
37.5 | 500 | Copper
50 | 650 | Copper
E
2,300 to 230/115 Single phase
2,300 to 230 Two-phase, three wire
2,300 to 230 Two-phase, four wire
2,300 Volt, Four Wire Primaries C
2,300 to 115 6,900 to 115 Single phase
2,300 to 230/115 6,900 to 230/115 Single phase
2,300 to 230 6,900 to 230 Three-phase, open delta
2,300 to 230 6,900 to 230 Three-phase, closed delta
2,300 or 6,900 Volt Three Phase, Three Wire Primaries B
Neutral
Do not fuse neutral
For 4,000 Volt circuits use 2,300 Volt transformers; for 12,000 Volt circuits use 6,900 Volt transformers.
Leave open
2,300 to 230/115 6,900 to 230/115 Single phase
4,000 to 230 12,000 to 230 Three-phase, open delta
4,000 to 230 12,000 to 230 Three-phase, star delta
4,000 or 12,000 Volt Three Phase, Four Wire Primaries D

FIG. 39—TRANSFORMER CONNECTIONS AND METHOD OF INSTALLING SECONDARY FUSE BLOCK

TABLE XIV—VOLTAGE RATING AND SIZE OF TRANSFORMERS

Weights given are for Westinghouse steel-clad (light-case) transformer and include the weight of oil. If heavier transformers are used, the type of installation must be selected which corresponds to the weight of the heavier transformer.

The figure numbers in the last column are for the detailed drawings for each installation. These drawings will be published in the April 19 and April 26 issues of the ELECTRICAL WORLD.

Primary Voltage	Secondary Voltage	Phases	Sizes of Transformer in Kva. (Inclusive)	Maximum Weight per Transformer, Lb.	Figure Number
2,300	230/115	1	1½ to 25	575	42
2,300	230/115	1	30 to 50	975	43
2,300	230/115	2	Two 5 to two 15	365	40
2,300	230/115	3	Three 5 to three 15	365	41
2,300	230/115	3	Two 5 to two 15	365	41
2,300	460 or 230	3	Three 20 to three 100	1,630	44
2,300	460 or 230	3	Two 20 to two 100	1,630	44
4,000	230/155	1	1½ to 25	575	46
4,000	230/115	1	30 to 50	975	47
4,000	230/115	3	Three 5 to three 15	365	48
4,000	230/115	3	Two 5 to two 15	365	48
4,000	460 or 230	3	Three 20 to three 100	1,630	45
6,900	230/115	1	3 to 50	1,250	49
6,900	460 or 230	3	Two 15 to two 100	2,175	50
6,900	460 or 230	3	Three 15 to three 100	2,175	50
6,900	2,300	3	Three 25 to three 100	2,175	51

to the pole above the arm with a ½-in. through bolt. At single transformer installations the transformer hangers shall be supported at the bottom by a wooden block cut from a standard cross-arm. The length of this block shall be such that it will project 2 in. on either side of the hangers. It shall be fastened to each hanger by a ⅝-in. by 4½-in. galvanized machine bolt put through the hanger, then through the block with a ⅝-in. cut washer under the nut. It shall be fastened to the pole with a ⅝-in. through bolt. When Pittsburgh transformers are used and the hangers are of the type which cannot be bolted to the above block, the block must be not less than 32 in. long and fastened to the pole with a ⅝-in. through bolt and two standard cross-arm braces.

At single-arm transformer installations, the cut-outs shall be mounted on the opposite side of the arm from the transformers. Where double arms are used the cut-outs shall be mounted on the far side of the back arm from the transformers and no braces shall be used on that arm.

Primary training wires shall be held taut on bolt pins installed on the same side of the cross-arm on which the cut-outs are mounted. These training wires shall not be smaller than No. 6 medium-hard-drawn copper. Where services are taken off the transformer pole in such direction that there is less than 6-in. clearance from primary training wires, an additional secondary rack mounted on extension brackets, if necessary, shall be installed at such point on the pole that the service wires will have that clearance.

Horizontal runs of primary wires on the arm on which transformers are mounted shall be made on bolt pins installed on the front of the arm and shown in the detailed sketches on drawings where such runs are required. The maximum height of bottom of transformer case above ground shall be 30 ft., the minimum height 16 ft. Where transformers are located close together, as in business districts, all transformers shall be mounted as nearly as possible at the same height above ground. With primary voltage of 4,000 volts or less the transformer cases shall not be grounded for pole installations.

Connections.—Standard transformer connections for 2,300-volt, 4,000-volt, 6,900-volt and 12,000-volt circuits are shown in Fig. 39 B, C and D. Connections not included in the illustrations shall be considered special connections and shall be approved by the distribution engineer before being used. Transformers shall in general be connected on the full primary winding (100 per cent taps), and notice shall be taken that transformers are so connected when installed. If because of low primary voltage it is necessary to cut out part of the primary winding to obtain normal secondary voltage (230/115 volts), this may be done. The exact connection used on transformers having taps shall be noted on the transformer report.

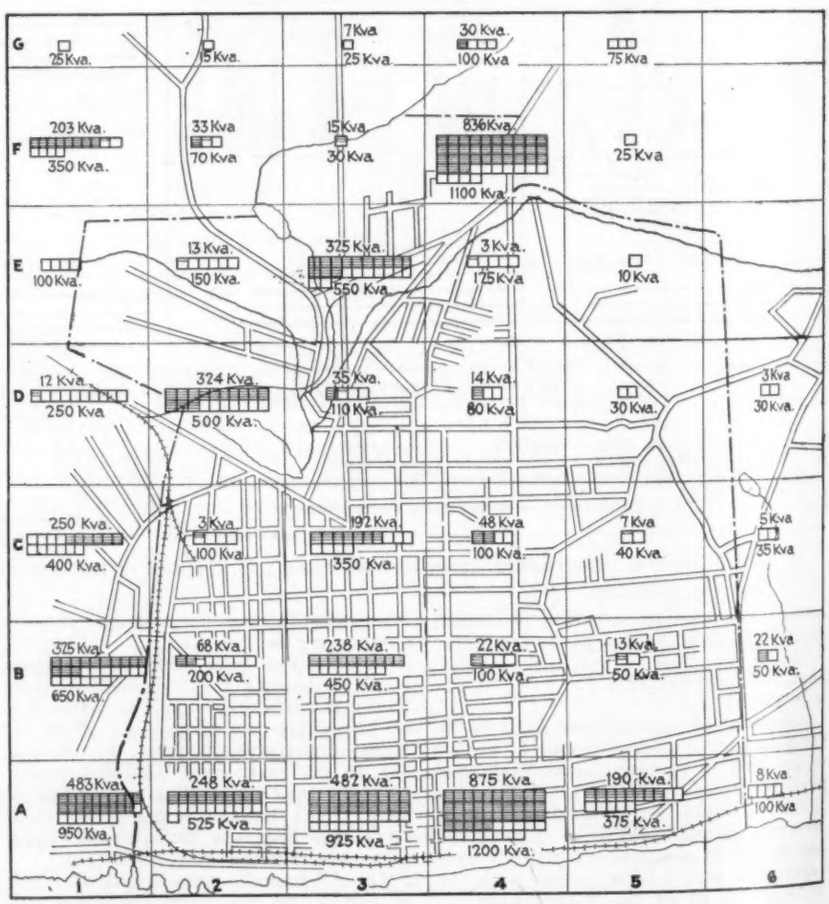
In general, all of the transformers in any polyphase installation shall be of the same make and type. This is particularly important for the 4,000-volt star-delta connection as heavy unbalance of secondary currents and voltages may result from using transformers with different characteristics.

The open-delta connection shall not be used for transformers larger than 10 kva. on 4,000-volt circuits and, in general, shall be used on 2,300-volt and 6,900-volt circuits only when definite increase of load, which will necessitate closing the delta, is expected.

In general, single-phase transformers 3 kva. and larger shall be connected three-wire and shall have three-wire secondaries.

Transformer Load Densities Shown Graphically

IN ORDER to show the transformer kva. density and the probable load growth by 1932, the chart shown in the accompanying illustration is used by the Central Hudson Gas & Electric Company of Poughkeepsie, N. Y. This map is



DISTRIBUTION LOAD THROUGHOUT CITY REPRESENTED GRAPHICALLY

The cross-sectioned squares represent units of 25 kva. transformer capacity for the year 1922, while the plain squares show the probable increase in transformer capacity that will be required by 1932. The 1922 figures are given above the squares, while the 1932 are shown below.

for the city of Newburgh, N. Y., in which an intensive distribution study has been made in regard to future requirements, and it shows in a graphical manner just what the transformer load is in each section. Each large rectangular section represents an area approximately 2,000 ft. square.

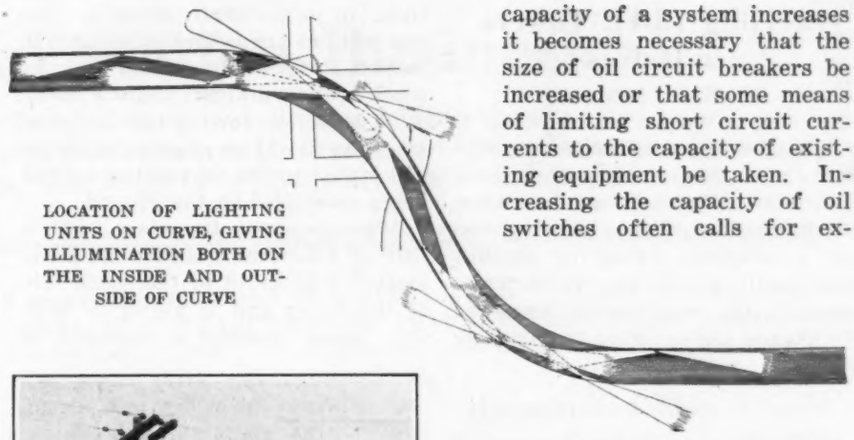
Within the large squares there are drawn smaller squares, each of which represents a transformer capacity of 25 kva. The present capacity is shown by the cross-sectioned squares, while the plain squares show the additional capacity that will probably be required in 1932. This graphical representation is of great assistance in determining the location of future substations, as the load centers can easily be found for each division into which the city may be divided.

Lighting Highway Curves Effectively

THE lighting of an "S" curve on a stretch of highway, in Oakwood, Staten Island, N. Y., presented a problem the solution of which should be of interest to engineers who come in contact with this type of street lighting work.

The curve is lighted with ten "Novalux" units, the total distance covered being about 2,400 ft. One of the accompanying illustrations shows how these units are laid out, the broad beams radiating from each unit indicating the zones of maximum intensity, although there is a large amount of light falling directly under the units and on the parts of the roads not covered by the bands of light shown.

Although it may seem that the light from some of the units is wasted in the adjoining fields, actually it is utilized to illuminate the trees, fields and houses at the end of the course so as to bring out more in detail the nature and steepness of the curve as well as the nature of the ground beyond the unit, thus safeguarding the driver by giving him a clear view of the curve.



LOCATION OF LIGHTING UNITS ON CURVE, GIVING ILLUMINATION BOTH ON THE INSIDE AND OUTSIDE OF CURVE

STREET LIGHTING INSTALLATION UTILIZING CONSTANT-CURRENT POLE-TYPE TRANSFORMERS

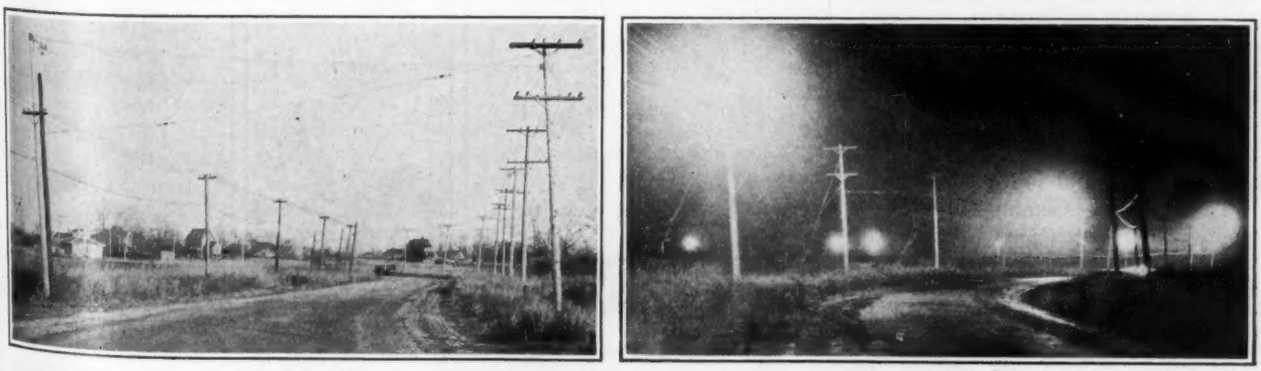
Reactors Save Replacing of Equipment

WITH the ever-increasing power demands on transmission networks and the heavy duty placed on oil circuit breakers and other equipment, the problem of limiting the short-circuit current on such systems has received the careful consideration of engineers. As the capacity of a system increases it becomes necessary that the size of oil circuit breakers be increased or that some means of limiting short circuit currents to the capacity of existing equipment be taken. Increasing the capacity of oil switches often calls for expensive rebuilding to accommodate the larger and more modern breakers.

Calculations have shown that in the case of the Redondo steam plant of the Southern California Edison Company it is possible to have an instantaneous rush of current of 17,000 amp. with a short circuit on the bus. By installing 300-amp., 5 per cent, 18,000-volt current-limiting reactors this rush of current in the system can be reduced to 7,630 amp.

Thus the duty on oil circuit breakers and other equipment can be reduced, resulting in greater safety of operation and economy. In addition, the reactors will help to protect the system as a whole against shutdown by maintaining the voltage on that part of the system not in trouble while the short circuit is being cleared by the automatic circuit breakers.

This company expects soon to install reactors at many of its stations, and six sets of three each have been ordered for the 11,000-volt feeders at its Long Beach steam plant. Specifications have been submitted to the manufacturers for about 135 reactors to be installed at twenty-seven stations. It is expected that 50 per cent of this work will be completed during 1924.



DAYLIGHT AND NIGHT VIEWS OF HIGHWAY CURVE IN STATEN ISLAND, N. Y., WHERE EXTENSIVE LIGHTING INSTALLATION HAS RECENTLY BEEN COMPLETED

Erecting 75-Ft. Towers in Halves

BY W. R. MCCANN
Stone & Webster, Inc., Boston

ON A newly constructed 115,000-volt, two-circuit steel-tower transmission line between Pawtucket and Woonsocket, Rhode Island, it was not practicable, owing to peculiar local conditions, for the contractor to assemble the steel towers prone on the ground and to swing the complete structure into erect position hinged upon two adjacent steel anchors. Therefore, the constructors adopted a process that required comparatively little burdensome field equipment.

The standard towers are 75 ft. in height, measuring 16 ft. x 16 ft. at the base and weighing 5,100 lb. including foundations. Anchor towers, averaging one in six owing to a large number of angles in the alignment, are of slightly different dimensions and weigh 7,100 lb. The towers carry six No. 2/0 copper cables and one ⅜-in. Siemens-Martin galvanized ground wire, sagged for a minimum clearance of 25 ft. to ground, under maximum loading conditions of ½-in. ice and 8-lb. wind, with a minimum temperature of 0 deg. F. The portion of the tower above ground consists of 257 pieces and 761 ⅝-in. bolts.

In order to explain clearly the method used in erection, the conventional north, east, south and west will be applied to the four sides of the tower, with the right-of-way extending north and south.

The tower is assembled in two sections. One section comprises the north side of the tower and the other section comprises the south side of the tower up to and including the bottom cross-arm. The bottom vertical members of each section are loosely attached by a single bolt to their respective foundation anchors; then, in a northerly direction, the two sections are assembled, the north section close to the ground and the south section propped slightly above it. The lacings for the east and west sides are as far as practicable bolted and lashed to the two sections while being assembled on the ground.

A gin pole (40 ft. cedar), with a pair of 8-in. double sheave blocks, is erected 2 ft. south of the south side of the tower and is guyed by four ¾-in. ropes attached to deadmen at 90 deg. points on a circle of 60-ft. radius. The section nearest the gin pole is raised first and held into position by three guys, one of which (a ¾-in. rope), is fastened to a stake in the ground in a southerly direction. The other two guys of ½-in. rope are run out in a northerly direction. The blocks on the first section are then slackened and attached to the second section, which is raised in the same manner as the first section. The lacings of the east and west sides of the tower are next bolted complete to hold the tower in position, and the gin pole and the blocks are released and taken down.

The top members and the cross-arms are erected piecemeal by the finishing gang, which also completes all lacing and bolting that is required on the tower.

The erecting gang consists of one foreman and six laborers, with a team of horses. The finishing gang consists of one pusher, three linemen and three laborers. This crew can completely erect two towers in nine hours, or a tower a day with seven men.

The transmission line was designed and built by Stone & Webster, Inc., for the Blackstone Valley Gas & Electric Company, Pawtucket, R.I., J. H. Clark, superintendent of construction.

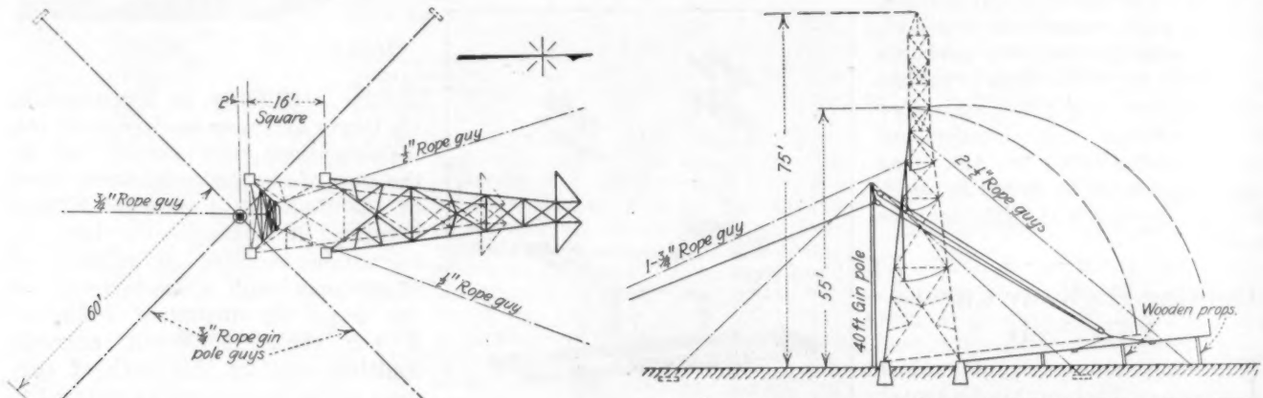


FIG. 1—TOWERS ERECTED BY ASSEMBLING HALVES ON GROUND, FOLLOWED BY TWO LIFTS WITH 40-FT. GIN POLE

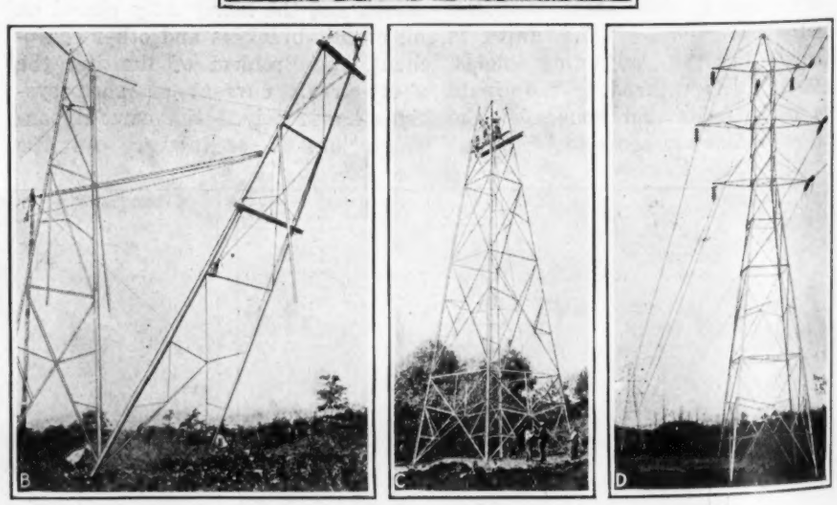


FIG. 2—TOWER ERECTION PROCESS USED IN BUILDING 115,000-VOLT LINE

A—Assembling halves of tower on props. B—One-half of tower erected and held by guy ropes. Other half being hoisted by tackle and gin pole. C—Both halves erected; side lacing in place, assembly of top and brackets begun. D—Tower erected, conductors strung and one circuit shown in transposition.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Payment of Lighting Bills Through Dealers

A PLAN has been presented to the electrical dealers of Denver by the Public Service Company of Colorado whereby customers of the power company may pay their lighting bills through the dealers of the city, providing a sufficient number of dealers wish to avail themselves of this offer.

This practice has been proposed by the Public Service Company of Colorado to meet the objection frequently raised as to the advantage the central station has in selling appliances through its contact with its customers when they come to pay their bills. If adopted the new scheme will allow the diversion of many prospective appliance sales to the dealers, provided they are aggressive enough to capitalize on this opportunity to make new friends and render this additional service. The success of the plan is now largely dependent upon the action of the electrical dealers of the city.

Duquesne Light Organizes Commercial Department

THE Duquesne Light Company of Pittsburgh has recently organized a commercial department, in charge of M. E. Skinner, commercial manager, which constitutes an expansion of the activities of the present contracting department to include rate studies, stimulation of the use of energy by present consumers, greater development of street lighting and closer relations with power consumers.

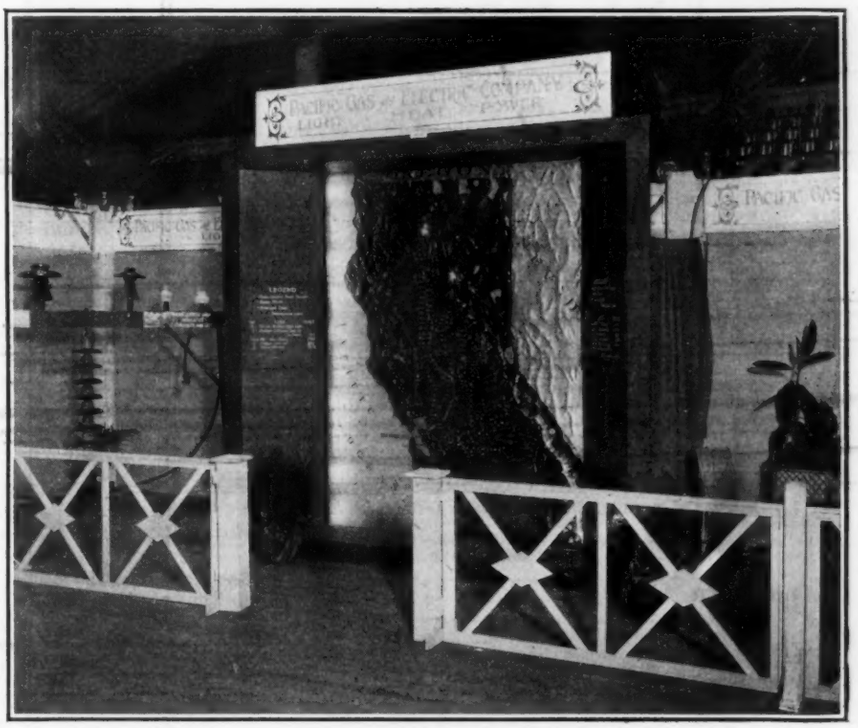
The establishment of this department will not in any way affect the sale of appliances, fixtures or house wiring, which will continue under the Equitable Sales Company, of which H. A. Keyes is vice-president and general manager.

In announcing the creation of the new department Arthur W. Thompson, president of the Duquesne Light Company, stated that the need for such a department to handle its commercial affairs was imperative because of the rapid expansion of the company. Under the commercial department there will be provided experts who will make available for customers information as to how they may obtain better use of their service. Included in the new department will be experts in electric furnaces, motor application, electric heating, electric refrigerating, electric vehicles, signs, power-factor correction, efficient illumination, electrotherapeutics, household appliances, home economics and other matters. This will afford to customers special information on any phase of electrical application to residential, commercial and industrial use.

Under the direction of the commercial department there will be a power bureau, which will take care of all industrial applications, a steam-heating department to arrange for the application of steam for heating the downtown section, and a municipal division to maintain relations with municipalities so that the problems of the municipalities and the company may be simplified.

Illuminated Map Shows Power Company's System

THE large relief map of northern California shown in the accompanying illustration is displayed by the Pacific Gas & Electric Company of San Francisco in its various district offices and at expositions and fairs to give the public an idea of the physical nature of its system. The principal power plants and transmission lines are indicated by miniature lamps. A flasher is used to light certain combinations of the lamps, and a legend on each side of the map tells what these mean. For instance, one set of lights will show all of the hydro-electric plants, another the steam plants, another the Pit River 220,000-volt transmission system, and so forth. The map always attracts considerable attention



PORTABLE RELIEF MAP USED BY THE PACIFIC GAS & ELECTRIC COMPANY FOR EXHIBITION PURPOSES

wherever displayed and serves as a readily available portable exhibit for the company.

Method of Development in Electric Sign Business

IN PROMOTING the use of electric signs in Omaha the Nebraska Power Company has been very successful through using standardized methods whereby customers obtain a flat-rate sign contract which in effect is a lease sale of the sign itself together with complete service and maintenance over a period of years. While the sign itself becomes the property of the consumer upon completion of the contract, the lamps, apparatus and miscellaneous equipment remain the property of the company. According to K. P. Goewey, sales manager, the form of contract was a considerable aid in effecting total sales of $115,700 in signs for 1923, which increased the kilowatt-hour consumption by 128,280.

An interesting feature in connection with this contract is that the company has developed a form of data sheet which shows the probable costs of any particular sign installation. These are very convenient in showing a prospective customer what a sign will cost him. A duplicate of the contract, signed by the company and the customer, is attached to the data sheet, as illustrated, and filed so that, in case of any discrepancy or change later on, all of the facts and costs governing the original installation are readily accessible.

In arriving at the monthly charge there is space on this data sheet to show the calculated cost covering the total cost of sign, number and size of the lamps, cost of wiring, the estimated monthly energy consumption and the cost of maintaining lamps, patrol and inspection service.

The charge to the customer is finally arrived at by taking account of the following items: The amount sufficient to amortize the total investment of sign, wiring, etc., over a period of months covered by the contract, the carrying charge (being the same as an interest rate), the cost of maintaining lamps, the cost of energy, together with the service charge which covers patrol, inspection and necessary repairs and repainting. The "relamp" charges vary from 4 cents to 8 cents per socket per month and depend somewhat upon the location and size of the sign and the extent to which it will be subjected to vibration and to storm damage. The Nebraska Power Company has found that where flashers are used, lamps will last from 10 to 33 per cent longer than where they are operated continuously. The relamp charges have been arrived at after keeping a very careful watch on the cost of relamping signs over a period of several years.

This contract entered into with the customer is in a regular form which stipulates that the company is to maintain the sign during the

SIGN DATA

Name .....
Address .....
Sign description .....
Number and size of lamps.....
Origin of prospect.....
Bids taken (attach letters to this form)
.....
.....
.....
Contract let to .....
Requisition number .....
Cost of sign, $.....
Cost of wiring and all equipment, $.....
Term of proposed contract.....
Current:
...hours...watts...kw.-hr., at $.....
Amortization sign and wiring - .....
Carrying charge (all investments) - - - - - - - - - .....
Relamp Charges:
...lamps, at...cents each - - .....
...lamps, at...cents each - - .....
Service charge - - - - - - - .....
Total - - - - - - - - $.....

Form of Contract to be Used in Case Company Erects and Sells Sign to Consumer

Nebraska Power Company

Memorandum of Agreement between Nebraska Power Company (hereinafter called the company) and..... (hereinafter called the consumer), made and entered into this..... day of.....A. D., 19....

THE COMPANY AGREES:

(1) That it will furnish an illuminated electric sign advertising..... at.....in the city of..... and all necessary lamps and current in connection therewith;.....

(2) That it will, during the term of this agreement, maintain said sign and all incandescent lamps, wiring and electrical equipment in good condition and supply the same with the necessary electrical current for successful operation during the term commencing at..... in the evening and until.....

(3) That it will remove such sign and equipment only upon payment of reasonable compensation therefor in addition to the sum herein agreed to be paid for the installation and maintenance of the illuminating equipment and service, and

(4) That it will employ due care and diligence to supply uninterrupted service during the hours aforesaid, but does not obligate itself therefor except that it will allow the consumer a reduction of the sum herein agreed to be paid and equal to the cost of lighting the sign during the period (if any) when the current fails.

THE CONSUMER AGREES:

(1) To obtain permission if necessary for the erection and maintenance in place of said sign.

(2) That.....will pay to the company for such service the sum of ..... Dollars covering the term of.....,.....years in equal monthly installments of .....dollars each (and the same rate for any fraction of one month) at the office of the company on the..... day of each and every month during the term of this contract.

(3) That upon the termination of this contract for any cause the consumer shall immediately pay to the company an amount equal to..... dollars per month from the termination of this contract to.....years from.....

THE COMPANY AND CONSUMER MUTUALLY AGREE:

(1) That this agreement is made for and shall continue in force during the full term of..... years, commencing on the..... and shall continue in force after the expiration of such terms until terminated by notice in writing given by either party to the other, or as otherwise herein provided.

(2) That the company shall have the right to terminate this agreement upon failure of the consumer to pay for service rendered within thirty days after rendition of said service.

(3) The consumer assumes no responsibility by this agreement for any damage resulting from electric shock or injuries caused by said sign or equipment.

(4) That the sign shall become the property of the consumer on the expiration or termination of this contract, as herein provided.

(5) That all lamps, apparatus and miscellaneous equipment (exclusive of sign proper), shall be and remain the property of the company.

Signed the date first above written.

NEBRASKA POWER COMPANY,

By.....
Sales Manager.

.....
Consumer.

contract period and that the sign can be removed only upon payment of a reasonable compensation in addition to the sum originally contracted for to cover the installation and maintenance of the sign itself. The contract definitely provides that the sign becomes the property of the consumer on the completion of the contract, but that the service shall continue until termination of the contract by notice in writing given by either party.

The contract also stipulates that in event the customer desires for any reason whatever to terminate the contract before the stipulated period he will reimburse the company in an amount slightly more than the company actually spent to give the customer service. This figure is the amount necessary to amortize the original cost, plus the carrying charge as shown on the data sheet and multiplied by the number of months of the contract that the sign has not been used.

Salem Wiring Campaign Offers Two Years to Pay

A HOUSE - WIRING campaign with the low initial payment of $5 and an allowance of two years to settle the total cost of the individual installation has recently been launched by the Salem (Mass.) Electric Lighting Company. An attractive circular, shown herewith, is being mailed to prospective customers, depicting the convenience and safety of electric service and inviting the recipient to inspect the electric home to be opened June 2 by the Essex County Electric Club at Salem.

What an electrified home means to you and your family
The best lighting ever devised by man
But also comfort, convenience, protection, and freedom from the drudgery of housework
Mail the card today
POST CARD
To
Salem Electric Lighting Company
205 Washington Street
Salem, Mass.

HOUSE-WIRING CIRCULAR TIES IN WITH HOME ELECTRIC

What Other Companies Are Doing

Hartford, Conn.—Ninety per cent of the local merchants exhibiting goods during the past ten months in the demonstration show window of the Hartford Electric Light Company on Ann Street have as a result of the demonstration either increased or improved the illumination of their own establishments. Forty merchants have exhibited in this way in the window for one week each, and in addition twenty-two local merchants who have not yet exhibited have installed new window lighting because of the demonstration. The general quality and intensity of business house illumination in downtown Hartford has been perceptibly improved by this lighting "experiment station," under the direction of W. D. Gorman, illuminating engineer of the Hartford company.

Ashland, Wis.—The plan for increasing the energy consumption by commercial customers put in effect about the first of this year by the Lake Superior District Power Company is producing satisfactory results in the form of increased load and revenue. An illuminating engineer has been employed whose duty it is to make surveys over the company's entire properties, impressing upon merchants and shopkeepers the value of proper shop-window lighting as an important sales stimulant.

Industrial Heating Courses Profitable to Central Station Power-Sales Engineers

LARGER numbers of central-station power engineers each year are taking advantage of the courses in industrial electric heating co-operatively given by the General Electric and Westinghouse companies under the auspices of the N. E. L. A. About fifty men registered in the 1924 courses, which have just been brought to a successful conclusion. In virtually every case where a power sales engineer has taken one of these courses he has returned to his home company fired with enthusiasm for this class of business, and the rapid growth of heating load on central-station lines is unquestionably due in no small part to this intensive educational work. On the left are shown the engineers who attended the school at the General Electric plant and on the right those at the Westinghouse plant.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Hydro-Electric Power in Ireland.—R. N. TWEEDY.—Several water surveys have been or are being made on the River Liffey in Ireland. In one section this river falls 1,165 ft. in a distance of 19 miles. There are three schemes proposed for constructing a reservoir in this region for supplying water to one or more power stations under a total head varying from 150 ft. to 220 ft. Several of the proposals are discussed, particularly in reference to the amount of power available throughout the year.—*Electrical Review (England)*, Feb. 15, 1924.

Effects of Soot Deposits on Boiler Efficiency.—J. T. BEARD, 2D.—Effects of soot deposits on boiler operation and how these conditions can be readily detected by the proper instruments are discussed. Mechanical soot blowers do the work most effectively and have a number of advantages over the hand lance and other methods of soot removal, according to the author.—*National Engineer*, March, 1924.

Calculating the Amount of Air Liberated in Barometric Condensers.—C. M. REED.—Air enters with cooling water, steam and by leakage, which may easily be calculated from charts given in the article. The author also describes how to select the most suitable type of vacuum pump for use in barometric condensers.—*Power*, March 4, 1924.

Correct Methods of Using Fuel Oil.—H. A. ANDERSON.—A marked economy is effected by the correct design of burner and furnace as it is the function of the burner to atomize the fuel completely, thoroughly mix it with the correct amount of air, gasify the finely divided particles of oil and then completely burn the gas, while the function of the furnace is to conserve and distribute the heat developed by the burner. The four types of the ordinary liquid-fuel burner are the vapor, mechanical, spray and combustion burner. After discussing each of these types, the author considers the design of the furnace. — *Railway Mechanical Engineer*, March, 1924.

Generation, Control, Switching and Protection

Transformer Standards. — Preferred ratings and system voltages for distribution transformers, standards for single-phase and three-phase step-up power transformers and the adoption of outdoor construction as standards are among the important new rules in the third edition of the "Transformer Standards" recently issued by the Electric Power Club. This edition also contains lead markings and vector diagrams, polarity connections, standard ratings, performance specifications, tests, methods of measuring losses and temperature and other material which has appeared in the previous editions.—*Booklet of the Electric Power Club*, January, 1924.

Modern Systems of Boiler Control.—J. B. C. KERSHAW.—While many large power stations which have been recently erected have a complete equipment of testing instruments, it is the author's opinion that it would be wise to increase rather than diminish the number of the instruments; for the cost of providing them is but a minor item, and in most cases the savings effected will pay off the cost of the equipment in a short time. The provision of a complete set of indicating instruments for each boiler and of recording instruments for each group of boilers is the ideal that should be aimed at. One or more especially trained men for this work should be placed in charge and given full control of the records. However, the most expensive instruments are useless unless an intelligent operator studies them in co-operation with boiler-house and turbine-room staffs. The author discusses modern methods of insuring this co-operation, particularly the various bonus systems now being used.—*Engineer (England)*, Feb. 8, 1924.

Transmission, Substations and Distribution

Automatic Substation for Electric Railways.—The article describes how the United Railways of St. Louis utilize full automatic substations in connection with manual stations to provide proper voltage conditions in the city. This company now has five full automatic substations in addition to two full automatic substations previously installed in the suburban area. The outstanding features are the general utilization of regular units instead of multiple units, housing of the units in small inexpensive buildings and the installation of a simple and efficient forced ventilating system, besides a general description of the substation control equipment, high-speed circuit breakers, labor-saving features and equipment details.—*Electric Traction*, February, 1924.

Dry Versus Oil-Type Transformer.—M. VIDMAR.—The author arrives at the conclusion that for an output not exceeding 150 kva. and potentials up to 10,000 volts the dry-type air-cooled transformer is cheaper and has fewer losses than an equivalent oil-cooled machine. Properly built, it is claimed that the air type is just as safe against electric puncture as the oil-immersed type. The dielectric properties of air are furthermore much more constant than those of oil. The only advantage of the oil type seems to be its considerable overload capacity, which, the author believes, is of no material advantage for sizes below 150 kva. Free and ample access of air to windings and core, properly dimensioned air ducts and air as the major electric insulation will result in a design of a dry-type transformer which is cheaper in first cost and subsequent operation at the same factor of safety as is expected of an oil type. The entirely open construction of the air type permits constant inspection. In case of a flash-over air is restored almost instantly to its former properties, while oil carbonizes and must be renewed.—*Elektrotechnik und Maschinenbau*, Feb. 10, 1924.

Units, Measurements and Instruments

Method for Measuring Starting Torque.—R. BRÜDERLEIN.—A dynamometer brake or a calibrated direct-current generator is the usual means to measure starting torque of motors. A new, and what seems to be a very simple, method is suggested by the author. A three-phase induction motor with wound rotor, with the same number of turns on stator and rotor, is so connected to a three-phase supply line that both the stator and the rotor are fed. Properly connected, the rotor will then remain in stable equilibrium. Any attempt to apply torque to the rotor will result in a circulating current between the two circuits which is proportional to the exerted torque. Measuring this current with a wattmeter in each circuit gives sufficient values to calculate the torque. It is also possible to connect stator and rotor in series, using one wattmeter only. As compared with the method employing a calibrated direct-current dynamo, the present arrangement is claimed to have the advantage that the speed of rotation, which may be zero or very low, is rigidly maintained independently of the torque, permitting convenient readings.—*Elektrotechnik und Maschinenbau*, February, 1924.

Measurement of High Pressure.—F. H. NEWMAN.—The ordinary type of barometer cannot be utilized for the measure of pressures greater than two or three atmospheres, owing to the inconvenient length of the mercury column. Several types of instruments devised to overcome this difficulty are described and commented on by the author. He considers the compressed-air-type manometer, the elastic-membrane type of gage, the optical lever manometer and the Piezo electrical manometer. The first type can be used up to 3,000 atmospheres, while the second type is very accurate up to 300 atmospheres. The last methods are particularly suited for recording explosion pressures.—*World Power (formerly Beama)*, February, 1924.

Illumination

Some Experiments on the Speed of Vision.—P. W. COBB —The question of the time required for light to make an adequate visual impression has recently become of fundamental interest in industrial lighting. The author shows in what way the speed of impression of the eye changes with change in the brightness level under various conditions, with the size of the test object and with the presence or

absence of confusion due to the images of other objects seen immediately before and after the test object.—*Transactions of I. E. S.*, February, 1924.

Colorimetry and Photometry of Daylight and Incandescent Illuminants.—I. G. PRIEST.—Studies, both theoretical and experimental, have been made on this subject, utilizing the method of rotary dispersion. This method is proposed as a complete and satisfactory solution of the practical problem of the visual photometry and colorimetry of all illuminants (including the important phases of daylight) whose spectral distribution approximates the Planckian formula closely enough to give a color match. This solution is based upon the principle of the additivity of homogeneous luminosities and the assumption of a standard visibility function. The method falls in the general class of substitution, "equality-of-brightness" methods. Tables and graphs have been prepared by which color temperature and intensity may be readily obtained from the instrument readings on the basis of any visibility which it is desired to assume as standard.—*Journal of the Optical Society of America and Review of Scientific Instruments*, Vol. 7, No. 12.

Motors and Control

Synchronous Motor Operation.—H. COTTON.—A theoretical analysis of the phenomenon of the pulling into step of synchronous motors. The non-salient pole motor such as the so-called synchronous-induction motor is considered first, followed by a discussion of the salient pole motor.—*Electrician (England)*, Feb. 22, 1924.

Motor Drive in the Inland Steel Company's Steel Mills.—F. J. CROLIUS.—This is the third and last installment of a series giving the features of the Inland Steel Company's plant at Indian Harbor. This part is devoted to the remarkable concentration of motor drive for the various mills.—*Blast Furnaces and Steel Plant*, March, 1924.

Group and Individual Drives.—R. W. DRAKE.—The second of a series of articles that analyze in detail the advantages of group and individual drives. The first article appeared in the February issue and discussed fully the principal reputed advantages of individual drive. In this article the author takes up the principal reputed advantages of group drives. — *Industrial Engineer*, March, 1924.

Heat Applications and Material Handling

Testing of Resistance Material for Heating Apparatus.—H. HELBERGER.—A standard testing set is described which gives the manufacturer of heating apparatus reliable data on the suitability of the resistance wire or band used. The material to be tested is wound on a small quartz tube and is heated for two hours to 1,000 deg. C. The ohmic resistance is measured before and after each heating, the mechanical ductility is tested before and after, and wire is observed for scaling after heating. A thermocouple pyrometer serves to measure the temperature, and a direct-reading ohmmeter gives quick-resistance readings. After these tests the temperature at which the wire burns out is determined. From a first-class heating-wire material a small increase of the ohmic resistance is expected after heating the first time, but no further increase after the second heating. The ductility should either increase or only slightly decrease. No scaling should be observed, and the burn-out temperature should be not less than 1,250 deg. C.—*Elektrotechnische Zeitschrift, Special Exposition Issue*, 1924.

Welded Rail Joints.—A summary of tests made to date as studied by the committee on welded joints of the American Welding Society are given. This summary comprises the results of a questionnaire prepared on five types of joints in commercial use and circularized by the committee. The report is forty pages long and contains much valuable information on methods of making joints and tests thereon.—*Journal of the American Welding Society*, February, 1924.

Electrophysics, Electrochemistry and Batteries

Varnishes in the Electrical Industry.—R. T. FLEMING and A. F. STEEL.—The characteristics most desirable in insulating varnish—that is, insulation value and resistance to moisture—are to be found in most commercial varnishes. Usually, however, they are accompanied by other properties not so desirable. It is the duty of a varnish manufacturer in the electrical industry to eliminate, or at least minimize, these properties, while at the same time preserving the special characteristics. In addition, insulating varnishes possess other specific properties, mainly concerned with their ultimate use or method of application, which at the same time affect the process of manufacture. The authors in the first of a series of articles deal with the characteristics, ingredients and process of manufacture of insulating varnishes—*World Power (formerly Beama)*, March, 1924.

Traction

Otheograph Record of Steam and Electric Locomotives.—P. M. GILLILAN.—Considerable interest has been manifested in the otheograph, especially by railroad engineers who have been studying for a number of years the effect of motive power and other rolling stock on the rail. As constructed for an initial installation for testing purposes, this device records graphically both the vertical and the lateral deflection of the rail as each successive wheel passes.—*General Electric Review*, March, 1924.

Electrification of the French Midi Railway. — A. BACHELLERY. — After a brief description of the experiments made before the war on the Midi Railway in the way of electric traction, the author gives an account of the extensive electrification work now pursued by that company, in accordance with the new standard regulations of the French government, and of the results already obtained on the electrified lines.—*Journal of Institute of Electrical Engineers, (England)*, March, 1924.

Railway Electrification in Austria and Hungary.—PARKER SMITH.—In Austria there existed privately owned electrified lines long before the Federal Railways interested themselves in this subject. The work of the Federal Railways did not reach fruition until post-war conditions made it a necessity. The four main lines to be electrified by June, 1925 are already well under construction. The second group, whose construction is to follow these, comprises ten lines totaling 1,135 km. of route and a total length of track of 1,786 km. The Federal lines have adopted a single-phase system at 15,000 volts, 16⅔ cycles, as being most convenient and economical. The whole question of electrification is said to be in a chaotic state due both to political and economic reasons.—*World Power (formerly Beama)*, February, 1924.

Telegraphy, Telephony, Radio and Signals

Transmission and Reproduction of Speech and Music.—W. H. MARTIN and H. FLETCHER.—Radio broadcasting has drawn attention to the problems involved in obtaining high quality in systems for the electrical transmission and reproduction of sound. This paper gives the general requirements for such systems, discusses briefly the factors to be considered in design and operation, and indicates to what extent the desired results can be obtained with the means now available.—*Journal of the A. I. E. E.*, March, 1924.

Directive Type of Radio Beacon and Its Application to Navigation.—F. H. ENGEL and F. W. DUNMORE. — The authors deal with a method of guiding a ship or airplane by means of radio signals sent from a particular type of directive radio beacon. The principle of operation of this beacon is described. Results of actual tests both on shipboard and on an airplane are given. The point is made that while this aid to navigation may be effective only over definite routes or courses, it has the advantage over other methods of direction finding in that no special receiving apparatus is necessary and that it gives an immediate indication of any alteration in the course caused by drift from wind or tide.—*Scientific Paper No. 480 of the Bureau of Standards.*

Oscillation Hysteresis of Triode Generators.—E. V. APPELTON. and F. S. THOMPSON.—The phenomenon of oscillation hysteresis exhibited by simple triode generators is discussed theoretically. A practical method of reception in which this phenomenon is utilized in a periodic manner is described. This method is suitable for continuous-wave and spark signals. A low-frequency electromotive force is introduced in the grid circuit of a simple triode oscillator in such a way that high-frequency oscillations are not produced in the absence of an incoming signal. A small signal of high frequency is, however, sufficient to produce a train of free oscillations once for every low-frequency cycle. Such free oscillations are rectified by the triode, and a signal of the impressed low frequency is heard in the receiver telephones.—*Journal of Institution of Electrical Engineers (England)*, February, 1924.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

The Economics of Overhead Costs

By John Maurice Clark. Chicago: University of Chicago Press. 502 pages.

The prospective reader of this book should receive both a warning and an exhortation. He should be warned lest he approach the book under a misapprehension regarding its scope and content; but he should be encouraged and urged to study the book for many reasons, including the good of his intellectual soul and the future of industrial civilization.

The warning is this: The book is no manual of cost accounting as might be implied from the title. The word "economics" has come to be so profanely used that such inferences are natural. It is with "economics" in its true sense that the author deals. He presents an interesting and brilliant analysis of the broad economic problem of unused capacity, of idleness of productive resources.

The significance of the Clark book is this—it is a pioneer attempt to study economic phenomena, not as they are assumed to be in his own little economic heaven, but as they are in this vale of tears. The material which he seeks to dissect, analyze and classify is the material which streams across the desk of the business executive. Instead of directing his entire attention to the declining marginal utility of the theoretical buns being devoured successively by the theoretically gluttonous child, he discusses balance sheets and methods of distributing overhead costs. It is a book which will tend to make practical business men more theoretical and economic theorists more practical—ends much to be desired.

Readers of the ELECTRICAL WORLD will probably be especially interested in Chapter XVI, "Public Utilities," in which the author discusses unused capacity in this field with particular emphasis upon the resulting problems of rates.

Handbook for Electric Metermen

By Meter Committee, Technical National Section, N. E. L. A. Fourth edition. New York: National Electric Light Association. 1,242 pages, illustrated.

This book, which has been out of print for several years, appears in an entirely revised and rewritten fourth edition with a large amount of added material. Prepared primarily as an aid to metermen and engineers, it includes instructions, descriptions, data and information on metering practices indexed for ready reference. The subject matter has been limited to American meters and practice and an endeavor has been made to standardize terminology. Descriptive data on meters include certain types no longer manufactured but of which many are still in use. Separate chapters for each manufacturer appear in a group followed by chapters on rotating standards, demand meters and switchboard instruments. Lists of questions are also provided which utility companies may use as a basis for examination in connection with the promotion of metermen. A bibliography arranged according to subject matter is included at the end of the book.

Technical Writing

By T. A. Rickard. Second edition. New York: John Wiley & Sons. 337 pages.

The engineer has a natural, or sometimes inculcated, desire for accuracy and perfection in mathematical expression and in the technique of engineering design, construction and operation, and he often believes that if the accuracy and method of his mental processes were applied to the solution of social and business problems, the results would be beneficial. It is surprising, therefore, that he lays himself open to the commonly expressed and frequently justified criticism that his technique in the use of written English is very poor. Whether the fault lies in the type of mind inherent in the natural engineer or in his training may be debated. At any rate, it remains an indictment against the engineer. Mr. Rickard says early in his book: "I have found that nicety of expression is regarded by many engineers as effeminate." Even if that is indeed a tendency, the engineer should respond to Mr. Rickard's logic when he points out that "the purpose of writing is to convey ideas and that ideas cannot be conveyed successfully in defiance of technique."

Mr. Rickard's book, developed into a second edition from its beginnings as a series of lectures to engineering students, is an excellent aid to any one—be he engineer or not—who desires to improve the technique of his writing. It is written in a spirit immediately contagious and in a style that is convincing. There is nothing abstract—the author is definite throughout and the book is replete with examples of how not to do and how to do, and usually with good reasons. If the author is overemphatic on such points as the proper distinction in the use of "that" and "which," he is at least always clear in his plea for a careful discrimination in choice of words and for their orderly arrangement. Writing is an art and not a science, and the development of a style is not accomplished by reading a textbook but rather by continued practice and study. But there are certain principles at the bottom of all good writing, and one cardinal principle is clearness in expression. In this, as well as in many other elements of the development of technique in writing, Mr. Rickard's book should help materially.

Book Notes

Superpower as an Aid to Progress. By Guy E. Tripp, New York: The Knickerbocker Press. 62 pp. illustrated.

A collection of six articles on superpower and water-power development which have already appeared in magazines or been read before associations. The book is non-technical in character and it was prepared largely for public information.

Foibles and Fallacies of Science. By Daniel W. Hering. New York: D. Van Nostrand Company. 294 pages.

A delightful picture of ideas which have persisted throughout the ages regardless of their lack of experimental foundation. The story of the various fallacies and foibles is in itself both interesting and instructive. They are largely remnants of the once prevalent practice of speculating and theorizing without experimenting. Some of these speculations have come true, but the early speculators are as little responsible for present realization as Jules Verne is responsible for the airplane and submarine.

Steinmetz and His Discoverer. By John T. Broderick. Schenectady, N. Y.: Robson & Adee. 24 pages, paper.

The author, an early associate of Dr. Steinmetz in the General Electric Company, points to E. Wilbur Rice, Jr., as the discoverer of Steinmetz, and their meeting in a Yonkers workshop thirty years ago is described. An outline of the growth of the electrical industry during the past twenty years follows as a prelude to Mr. Broderick's description of the influence of the two men on electrical progress.

Books Received

The Blue Book—The "Electrician" Electrical Trades Directory and Handbook, 1924. Forty-second editon. London: Benn Bros. Ltd. 1,375 pages.

Die Porzellan-Isolatoren. By Prof. Gustav Benischke. Second edition, enlarged. Berlin: Julius Springer. 116 pages, illustrated.

The Control of the Speed and Power Factor of Induction Motors. By Miles Walker. London: Ernest Benn, Ltd. 151 pages, illustrated.

Principles of Electroplating and Electroforming. By William Blum and George B. Hogaboom. New York: McGraw-Hill Book Company. 356 pages, illustrated.

Practical Experience in Modern Business Correspondence. Bureau of Commercial and Industrial Affairs. Boston: Chamber of Commerce. 96 pages.

Diathermy and Its Application to Pneumonia. By Dr. Harry Eaton Stewart. New York: Paul B. Hoeber, Inc. 210 pages, illustrated.

Principles of Electric Motors and Control. By Gordon Fox. New York: McGraw-Hill Book Company, Inc. 499 pages, illustrated.

Wiring for Light and Power. By Terrell Croft. New York: McGraw-Hill Book Company. 551 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Muscle Shoals Up Again

Senate Committee Hearings to Begin Next Week Without Testimony on Ford Bill—A New Offer

HEARINGS on the various Muscle Shoals projects will begin before the Senate committee on agriculture and forestry on April 16. No hearings will be held on the Ford offer, the committee being unanimous that there is sufficient data regarding this bid already in the record. A definite program has not been decided upon, the order of procedure being left to Chairman Norris, but it is probable that the first two days will be devoted to the Wadsworth bill embodying the Hooker proposal for the formation of a semi-government corporation to operate the hydro-electric development and the nitrate plant.

As a prelude to the forthcoming debate in the Senate, Senator McKinley of Illinois on April 7 addressed the Senate in opposition to the Ford offer. By inference he favored the offer of the associated power companies of the South.

New Offer to Come Up

A new offer will be presented to the committee by James T. Lloyd, a Washington attorney who was formerly a member of the House from Missouri. This bill, of which the backers have not been named, has been drawn by J. H. Levering, a Los Angeles engineer, and is similar to the Morin bill, introduced in the last Congress. It provides for the creation of a corporation to be called the American Nitrate Corporation, with a capital stock of $10,000,000, to lease and operate for fifty years the government plant at Muscle Shoals for the production of fertilizers, the generation of water power and contingent purposes. Of this corporation it is provided that there shall be five directors, two to be selected by the Secretary of Agriculture. The Secretary shall set the maximum price for fertilizers. Contracts for the sale of surplus water power are to be subject to the regulation of any state where the power is used. Preference right to purchase is to go first to states contiguous to the project, second to political subdivisions of these states, third to industries located therein, and fourth to power companies for resale. A research department is to be conducted in co-operation with the Departments of Agriculture and War. Work on the completion and equipment of the development at Muscle Shoals is to be begun by the corporation within ninety days of its authorization.

Civil Engineers Oppose Ford

At the Atlanta meeting of the board of direction of the American Society of Civil Engineers last week a resolution was passed declaring that the government property at Muscle Shoals should not be sold until full information on power, on nitrogen-fixation possibilities and on costs shall have been collected by a fact-finding commission and that legislation respecting the Muscle Shoals development should conform to the federal water-power act. The board also resolved that Congress should give opportunity for presentation of plans by which the cost of the plant may be recovered in the shortest possible time and that it should place the sale or lease of the plant on an open competitive basis.

Newton D. Baker, former Secretary of War, has written a letter in which he says: "I am of the belief that the Congress should retain Muscle Shoals, provide for its operation directly by the Corps of Engineers of the army or by a public corporation analogous to the Panama Railroad Company, and through such operation deal with the power produced in the mass, without entering into retail operation."

Cities Service Company Seeks Colorado Power Stock

Negotiations for the purchase of not less than 35 per cent, or approximately 37,500 shares, of the common stock of the Colorado Power Company, at $35 a share, are being made by A. B. Leach & Company, New York brokers, at the instance, it is understood, of the Cities Service Company, the holding company for the Henry L. Doherty properties, among which is the Public Service Company of Denver, formed last year by the merger of the Denver Gas & Electric Light Company and the Western Light & Power Company of Boulder, Col.

A letter to the stockholders of the Colorado Power Company says the offer of $35 a share "has been extended to all holders of common stock of the company who prior to June 15, 1924, shall have deposited their stock for the purpose of such sale with the Old Colony Trust Company, 17 Court Street, Boston, or with the Irving Bank-Columbia Trust Company, 60 Broadway, New York. No stock, however, will be tendered to or taken by the purchaser unless at least the minimum aggregate amount of 35 per cent of the shares outstanding in the hands of the public shall be delivered." There are 110,512 shares of this stock outstanding, of which 106,049 are in the hands of the public and 4,462 with the trustees under the reorganization trust of 1916. Directors of the Colorado Power Company have already deposited their holdings under the plan described, as have the Electric Bond & Share Company and other stockholders.

No Hydro Act in New York

Legislature Adjourns Without Breaking Deadlock—Governor Dreads Private Development

IN ACCORDANCE with prediction, the New York State Legislature ended its session on Thursday with no water-power act of any description to its credit, it being found impossible to break the deadlock between the Republican Assembly and the Democratic Senate. The Senate passed the Rabenold bill, incorporating Governor Smith's ideas, by twenty-nine to thirteen, three Republican members voting with the majority. The corresponding bill in the Assembly was defeated by seventy-one to sixty-three, one Republican supporting it. The various other bills affecting public utilities and the Public Service Commission were also lost because of the failure of all efforts at compromise, with the exception of certain "home-rule" legislation which the courts will probably be called on to interpret. An eleventh-hour compromise measure affecting the transit situation in New York City was introduced in an attempt to put the problem up to Mayor Hylan. It did not eliminate the State Transit Commission.

Governor's Final Protest

Following the defeat of his water-power bill, the Governor sent a message to the Assembly on Wednesday urging that it be recommended. Alluding to Washington scandals, the Governor went on to say that unless his bill, with the clause declaratory of the state's permanent ownership policy, was enacted the present water-power statute, enacted during the Miller administration and providing for private development of hydro-electric energy under leases from the state and under state regulation, should be repealed as placing the state's interests in distinct jeopardy.

"There is nothing to the contention that we need have no fear of private development," the Governor declared. "Preliminary permits have already been granted to two power corporations to develop the electrical energy of the St. Lawrence River at Croile Island and in the Long Sault Rapids. Any time that either of these two power companies sees fit to submit its plan the New York Water Power Commission would have it within its power to grant a license for this private development. Further than that, there are applications pending for permits to utilize the water of the Niagara Gorge, where the diversion of 40,000 cu.ft. a second is requested. So that we find ourselves in a position at present where these natural resources which belong to all of the people of the state can be given away and nothing in the Assembly bill seeks to protect the state."

Birmingham A. I. E. E. Convention Scores Success

The spring convention of the American Institute of Electrical Engineers opened at Birmingham, Ala., on Monday, April 7, under favorable auspices for its success and was in full swing as the ELECTRICAL WORLD went to press. The technical sessions were varied by entertainment and by trips to nearby places of electrical interest, including the Mitchell Dam and Lock 12 development of the Alabama Power Company. A full news and technical report of the convention will be printed in an early issue.

Interconnection Offsets High Water in New England

Although the generating capacity of hydro-electric plants in central New England was somewhat curtailed this week by a sudden rising of streams following heavy rain, little or no damage to central stations is reported in response to telephone inquiries by the ELECTRICAL WORLD on Wednesday afternoon. The United Electric Light Company, Springfield, Mass., was obliged to operate its Birchem Bend and Indian Orchard stations at reduced output during the high-water period on the Chicopee River, and the Turners Falls (Mass.) Power & Electric Company encountered high tailwater at its Cabot station on the Connecticut River. Interconnection between the two companies again proved useful. The Westfield River attained an unusual height, but no electric utilities of size occupy generating sites on this stream. On the Connecticut River there was a rise of about one foot in one day at the Vernon (Vt.) plant of the New England Power Company. The Deerfield River plants of this organization functioned satisfactorily. High tailwater but no flood damage was reported by the Manchester (N. H.) Traction, Light & Power Company, operating hydro-electric stations on the Merrimac.

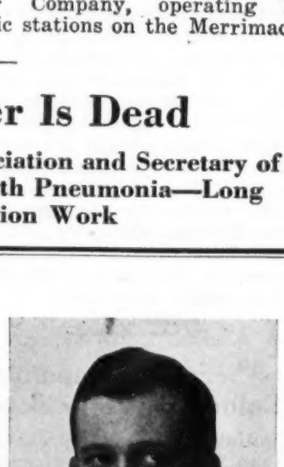
Walter Neumuller Is Dead

Treasurer of National Electric Light Association and Secretary of New York Edison Company Stricken with Pneumonia—Long Prominent in Association Work

WALTER NEUMULLER, treasurer of the National Electric Light Association, secretary of the New York Edison Company, and widely known throughout the electrical industry as a result of his activity in association work, died at his home in Port Chester, N. Y., early on Wednesday of this week from an attack of pneumonia contracted two weeks before his death and rapidly increasing in severity. The funeral services were held at his late home on Friday afternoon.

Mr. Neumuller was looked upon as one of the most promising of the younger men prominent in central-station affairs. Though still under forty, he had attained an extraordinarily wide popularity and influence. He had ability of an unusual order and coupled with it a personality that had won for him a great number of very warm friends. Gifted also with rare tact, he possessed to a remarkable degree the faculty of winning the confidence of men and of harmonizing conflicting interests in association work. His time and energy had always been generously given in the service of the industry.

Mr. Neumuller was born in New York in 1886. He attended the public schools and a business college and continued his study privately for many years. He entered the employ of the New York Edison Company in 1900 as office boy in the contract and inspection department. In 1907 he became private secretary to Arthur Williams, then general inspector of the company. He won continued promotion, becoming successively special representative, assistant commercial manager, assistant secretary and finally secretary. He also held office in the Yonkers Electric Light & Power Company and the Thomson-Houston Electric Light Company of



WALTER NEUMULLER

Yonkers, N. Y., the Electrical Show Company and the New York Electric Garage Corporation.

At various times Mr. Neumuller served as assistant secretary of the Association of Edison Illuminating Companies, secretary of the exhibition committee of the N. E. L. A., chairman of the membership committee of the N. E. L. A. (continuously from 1909 to 1912), president of the New York Electrical League, vice-president and life member of the New York Electrical Society, president and director of the New York Electric Vehicle Association and on many committees of these and other organizations. He was elected treasurer of the N. E. L. A. at the Atlantic City convention in 1922 in succession to Harry C. Abell. He was also a member of many national and local clubs. Mr. Neumuller is survived by a widow and two young sons.

Boston Finance Board Favors All-Electric Street Lamps

The Boston Finance Commission has sent to the Mayor and City Council a communication attacking a proposed contract with the Boston Consolidated Gas Company for street lighting in areas not at present served with electric lighting. The commission urged that the company's bid be rejected on the ground that in ten years the city would be obliged to pay at least one million dollars more for service than with an electric street-lighting system. About 9,500 gas lamps are involved, at a price of $26.20 per lamp per year. The commission recommends that immediate steps be taken to replace the present gas street-lighting system with electricity and condemns the quality of illumination furnished by the gas units. An extended report by Guy C. Emerson, consulting engineer of the commission, forms a part of the communication to the city authorities.

Mr. Emerson's report points out the basis of the above estimate of savings by the substitution of electricity (excess cost of gas lamps per year estimated at $7.78 for a 40-cp. lamp and $5.45 for a 60-cp. lamp) and states that in his opinion the Edison Electric Illuminating Company of Boston would be obligated to take over this service if the city so elected under the terms of the Edison-Boston lighting contract of December 7, 1914.

In a rejoinder to the communication, Commissioner of Public Works Joseph A. Rourke states that the Boston Edison company is losing money on its existing 40-cp. and 60-cp. multiple street lamps at $18.33 and $21.14 a year respectively and maintains that no agreement has been reached as to the price at which electric street lamps will be served under a new contract. The commissioner, admitting electric street lighting to be superior to gas illumination, contends that until such time as the Edison company feels that the extension of its service to replace all existing gas lighting will not impose too great a financial burden upon the company and possibly interfere with the extension of household and commercial lighting, and until the Edison company's willingness to assume this business becomes more evident than at present, gas lighting should be continued.

Initiative Petitions for Water-Power Act in California

Initiative petitions to place a water-power act on the ballot for the elections next November appeared on the streets of San Francisco and Oakland on April 8 and will be circulated in the larger cities of California to obtain the 77,263 signatures necessary. The new act is virtually the same as the one which was defeated by a vote of about three to one two years ago. It is summarized as being "a water and power initiative measure amending the state constitution and creating a board of five, appointed by the Governor and subject to recall, which is authorized to develop and distribute water and electrical energy, acquire by any legal means any property therefor and do

anything convenient thereto, including using and reserving state lands and waters." It gives the state and political subdivisions certain preferential rights as against privately owned public utilities selling water or electrical energy to the public. In addition, it authorizes the issuance of state bonds not exceeding $500,000,000 to further such purposes and requires the board to fix rates to meet expenses and retire the bonds in fifty years.

Talk on Utility Financing

Great Lakes N. E. L. A. Discusses Also Small-Plant Rejuvenation and Accrued Depreciation

AT THE opening session on Wednesday of the Middle West Geographic Division of the N. E. L. A., which met this week at Kansas City jointly with the Missouri Association of Public Utilities, J. F. Porter, president of the Kansas City Power & Light Company, spoke on public utility financing, tracing its development from the early stages when it was backed by local bankers. The next step was the formation of syndicates to hold the common stock. These helped furnish more money for another stage of development. The present method of selling stock direct to customers is free from objections inhering in the other systems and keeps the control in the city served. Mr. Porter thought that not more than 60 per cent of the capitalization should be furnished through bonds.

Mrs. D'Arline Holcomb, who operates small plants in five Missouri communities, spoke of her method of rejuvenating worn-out plants first by installing oil engines and eventually by tying in with transmission lines. Referring to the great use for electricity brought about by the sale of appliances, she laid special stress on obtaining the good will of the community.

A paper by J. W. Dana on theoretical accrued depreciation was read by C. F. Taylor, Kansas City. It pointed out that while this factor should be considered in the case of individual machine units a proper maintenance schedule would not require it to enter in rate cases where the property is considered as a whole. A plant and its organization will continue to run indefinitely if its component parts are kept up properly, and Mr. Dana held that there could be no justification for a 15 per cent depreciation charge in determining reproduction value.

The Thursday morning session was devoted to a question box and open discussion, with subjects assigned to different members. In the afternoon at a joint meeting of the two associations addresses were made by J. E. Davidson, vice-president N. E. L. A., Omaha; George A. Hughes, Chicago; W. S. Vivian, Chicago, and J. B. Sheridan, St. Louis. The joint banquet was held Thursday night.

Friday's program included a report on rural electrification by Arthur Huntington with discussion by G. C. Neff, a commercial session under the leadership of F. S. Dewey, Kansas City, with talks by N. T. Wilcox of Boston and J. L. Harvey of Wichita, Kan., and an address by M. H. Aylesworth. Officers were to be elected on Saturday.

Many Water-Power Projects Before Board

Wallenpaupack, Deschutes, Sultan and Chattahoochee Among Streams for Whose Development Authorization Is Sought—Ill-Advised Municipal Projects

THE Pennsylvania Power & Light Company has applied to the Federal Power Commission for a license covering its project on the Wallenpaupack River in northwestern Pennsylvania. The application shows that the company plans to construct a reservoir to store 160,000 acre-feet of water. A pipe line, developing a head of 300 ft., will lead from the reservoir to the power house on the Lackawaxen, where 54,000 hp. will be developed. That plant is to be connected with the company's existing steam plant and will provide the peak power for its system in the Allentown region.

An application for license has just been filed with the commission by the Columbia Valley Power Company to cover its important proposed development on the Deschutes River in central Oregon. The company in its application states that it is ready to proceed with the construction of the works to be erected on the Pelton site, where it plans to construct dams 125 ft. high to develop 51,000 hp. The company also says that a market has been obtained for all of the power which will be developed at the Pelton dam.

On completing that part of the project, the company means to proceed immediately with its work on the Metolius dam, where it plans to build an arch dam 270 ft. high and to develop 120,000 hp. Other known possibilities within the range of the development will, it is asserted, bring the total potential power of this portion of the Deschutes River and its tributaries to more than 500,000 hp.

To Develop Sultan River

The Sound Power Company of New York, which has been interested for many years in a proposed development on the Sultan River near Everett, Wash., and which holds a preliminary permit covering the site, has filed an application for a license, stating that it is ready to proceed with construction. An upper project capable of developing 65,000 hp. and a lower project capable of developing 80,000 hp. are planned. The applicant expects to find an industrial market for most of its power, which will be used chiefly in pulp and paper manufacture and in connection with forest product industries. It expects the cost of development not to exceed $90 per installed horsepower. Like the Priest Rapids development on the Columbia and that of the Columbia Valley Power Company on the Deschutes, this project involves the creation of an entirely new market.

A declaration of intention has been filed by the Columbus Electric & Power Company for its project on the Chattahoochee River at a point 18 miles above Columbus, Ga., where the ultimate output is put at 80,000 hp. The Chief of Engineers reports that the large storage capacity of this proposed development will affect the navigable capacity of the Chattahoochee below Columbus, and he recommends that the commission take jurisdiction.

The commission has taken jurisdiction over the project of the town of Galena, Mo., on the James River. The town filed a protest against the report of the Chief of Engineers, which holds the river to be navigable at that point. The commission allowed thirty days for the town to show any error in the engineer's report, but no such showing has been made.

The Wynooche Conflict

The city of Aberdeen, Wash., has applied for a preliminary permit covering its project on the Wynooche River. As previously stated, this project is in direct conflict with the proposed development of the Sanderson & Porter utility known as the Grays Harbor Light & Power Company. Without obtaining rights, without a survey or an engineering study to determine the feasibility of the development or its cost, the city has by a bare majority voted a bond issue of $2,000,000 for the undertaking.

The chief counsel of the commission has rendered an opinion in which other government law officers concur to the effect that the commission is without authority to institute injunction proceedings against those who insist upon constructing power projects above the navigable portion of a river which will not affect directly the navigable capacity of the waters below. This ruling precludes the commission from taking action against the town of Andrews, N. C., which has insisted on carrying forward a small power project which absolutely prevents a program for the larger use of the river's resources.

James B. Girand has withdrawn his construction force from his project at Diamond Creek on the Colorado River, in compliance with the terms of a temporary federal injunction. On the initiation of the Department of Justice, Mr. Girand has been asked to suspend work until the court can consider the advisability of making the injunction permanent.

Permits have been authorized in favor of the Juniata River Water Power Company and the Watts Water & Power Company of Pottsville and Harrisburg, Pa., and in favor of Alice B. Jones, Charles W. Thuringer and Gay, Otto & Diefendorf for projects on Rains Creek, near Boulder, Col.

Extensions of preliminary permits have been allowed the following applicants: R. W. Rawley, San Francisco; B. H. Hardaway, Columbus, Ga.; St. Cloud Public Service Company, St. Cloud, Minn.

Rejected Applications

In order to clear its records, the Federal Power Commission has authorized the rejection of a number of applications for preliminary permits or licenses. These applications concern projects which the applicants are not prepared to develop or for which the market will not justify development within a reasonable time. In the following cases the applicants raised no objection:

Alabama Power Company, proposed project on Coosa River near Lock No. 2; Southern California Edison Company, Salmon Creek reservoir and Horse Creek diversion; San Joaquin Light & Power Company, main stream of Kings River; city of Denver, South Platte River.

Despite a vigorous protest from Duncan Young & Company, the commission has rejected an application proposing a comprehensive development of the Delaware River which has been pending nearly four years. The company claims that it has made large expenditures and has property holdings on the river.

A preliminary permit issued to Joseph B. Leighton of Miles City, Mont., covering a proposed project on the Yellowstone River at Buffalo Rapids, has also been canceled because of failure to carry out certain conditions of the permit. For similar reasons a preliminary permit granted to the Eureka (Mont.) Hydro-Electric Company, covering a proposed project on Graves Creek, has been canceled.

Third Unit of Caribou Plant Completed

Completion of the third unit of the Caribou power plant of the Great Western Power Company of San Francisco was announced last week. This unit, which has been under construction for ten months and cost approximately $1,000,000, will add 32,000 hp. to the capacity of the plant.

The Caribou power plant is in Plumas County, California, and on the upper reaches of the Feather River. With the new unit it now has an installed capacity of 96,000 hp., which is one-half its ultimate capacity. The plant represents an investment of $14,000,000.

Reclamation Service Reverts to Headship by Engineer

Conduct of the federal government's reclamation activities again is in the hands of an engineer. D. W. Davis, the business man chosen by Secretary Work as Commissioner of Reclamation, has been removed from that position and placed in charge of a newly created Division of Finance. Dr. Elwood Mead has been selected as his successor, his appointment being understood to be due directly to President Coolidge. Dr. Mead has had a lifelong experience in irrigation administration, and his appointment is highly praised by Arthur P. Davis, the former head of the bureau, whose removal by Secretary Work caused a nation-wide protest from engineering bodies. It is understood that Dr. Mead is to receive a salary of $11,000. No salary in excess of $7,500 has been paid heretofore to the head of the Reclamation Bureau.

More than five hundred engineers attended a formal dinner April 5 at which Arthur P. Davis was the guest of honor. The dinner was under the auspices of the District of Columbia Section of the American Society of Civil Engineers and of the Washington Society of Engineers. Secretary Hoover and former Secretary of the Interior James A. Garfield were among the speakers.

Orders Funds Restored

Court Directs Los Angeles Power Bureau to Refund $12,000 Spent for Political Purposes

MEMBERS of the Board of Public Service Commissioners of Los Angeles have been ordered to restore to the city treasury more than $12,000 spent by the Bureau of Power and Light in campaigning for the thirty-five-million-dollar bond issue last spring. A decision to this effect was handed down on April 3 by Judge Butler of the Superior Court on the petition of W. W. Mines, a Los Angeles taxpayer. The commissioners and Power Bureau admitted spending the money, but contended that the expenditures were justifiable. The court swept aside these contentions and declared in effect that the commission is bound under charter to expend power revenues only for the administration and expansion of the property itself and not for political purposes. The expenditures in question included the hiring of bands, printing many thousands of circulars and posters and other forms of propaganda. The inference is that the money thus used will have to be paid back out of the pockets of the commissioners themselves.

Literature now being sent out by the Power Bureau in support of the twenty-one-million-dollar power bond issue to go before the electors on May 6 represents the same kind of expenditure declared illegal in the decision of Judge Butler. The case will probably be appealed to the higher courts. Other threatened taxpayers' suits will seriously hamper the Bureau of Power and Light and place it in an embarrassing position. It is alleged by these taxpayers that large sums have been spent on political lobbying trips to Washington, that a donation of $1,500 a month is now being made to the Boulder Dam Association, that $75,000 was donated to the United States Reclamation Service, and that large sums have been spent by the bureau in the Imperial Valley to stir up support of the Swing-Johnson bill now pending in Congress

Reduced Rural Rates in the San Joaquin Valley

Farmers in the San Joaquin Valley will be saved $125,000 a year in electric rates as the result of reduced rates for agricultural power service placed in effect by the San Joaquin Light & Power Corporation this month. The reduced rates are the result of several months' negotiation between the California Farm Bureau Federation, the Railroad Commission and the San Joaquin Light & Power Corporation. The reductions vary from 5 to 10 per cent, expect in a few extreme cases, and average about 7½ per cent.

The new schedule consists of an annual service charge based on the size of the consumer's installation and an additional charge at a comparatively low rate for the energy used. The demand charge per horsepower per year and the energy rate for 1,000 kw.-hr. per horsepower are as follows: 1 hp. to 4 hp., $7 and 1.5 cents; 5 hp. to 14 hp., $6 and 1.4 cents; 15 hp. to 49 hp., $5 and 1.4 cents; 50 hp. to 99 hp., $4.50 and 1.35 cents; 100 hp. and over, $4 and 1.3 cents. For all motor sizes the energy rate for the second 1,000 kw.-hr. per horsepower is 9 mills, for the third 1,000 kw.-hr. 7 mills, and for all over 4,000 kw.-hr. 6 mills.

The Insurance Policy Holder and the Central Station

A leaflet signed by Haley Fiske, president of the Metropolitan Life Insurance Company, has been sent to six million policy holders of that organization in which the part that investments in the securities of electric light and power companies play in the maintenance of this great mutual insurance company, with its thirty million policies and its assets of nearly a billion and a half dollars, is forcibly brought out. Mr. Fiske says:

"Your life insurance company does not speculate. It makes investments to keep. There can be no doubt that light and power distribution is a most important element in our life, in the community, in the neighborhood, in the household. The life insurance company has the right to insist upon honest, wise, prudent administration on the part of the companies; to demand that there shall be no exploitation of population or investors, that the customers shall be fairly and generously treated and that the public utility shall be fairly and honestly regulated.

"It must be recognized that not corporate abstractions but the American people are the owners of the bond capital of the companies. Every policy holder is *ipso facto* a capitalist, and an attack upon capital investments is an attack upon the wage-earners of the country. It is the working people who suffer first when there is lack of service afforded by public utility corporations, because it is they who are chiefly dependent upon such service. It is their capital invested through banks and insurance companies which develops this service for the people. It is the poor and the people of moderate means whose aggregate savings are invested in these enterprises.

"Plans for municipal, state or federal ownership of public utilities often sound well as presented by their advocates. But before assenting to them every policy holder should examine them carefully, asking himself how political ownership can possibly give him results to compare with those attained through private ownership."

Survey and Census Reconcile Energy Output Figures

Disparity in the figures issued by the Bureau of the Census and by the United States Geological Survey covering production of electricity at central stations has caused a renewal of discussion as to how these figures should be handled. Engineers apparently lean to the use of specialists for the gathering of such statistics. An engineer familiar with the industry and with the use to be made of the statistics is thought to be in a better position to gather them than is a statistical bu-

reau. There is some advocacy of placing all statistical activities under the Bureau of the Census.

In the case of the figures of the United States Geological Survey covering the total production of electricity by central stations and electric railway power plants for 1922, issued June 20, 1923, an aggregate of 47,659,000,000 kw.-hr. was arrived at. The census figures, which were issued four months later, showed a total of 45,308,000,000 kw.-hr. This difference of approximately 5 per cent led to demands from the industry for an explanation. On revising its figures the Census Bureau is understood to have found that the total should have been 47,375,000,000 kw.-hr. This narrowed the difference between the two bureaus to 283,000,000 kw.-hr., or only six-tenths of 1 per cent.

The revision of the Geological Survey figures showed one duplication of 75,000,000 kw.-hr. That resulted from a company in Illinois which purchased that amount of power including it in its report of generated power. The Geological Survey figures include certain plants not included in the United States Census figures. Allowance for those two items brings the two sets of figures to within 15,500,000 kw.-hr. of agreement, or three-hundredths of 1 per cent.

Tennessee Excise Tax Held to Be Constitutional

The Supreme Court of Tennessee has handed down a unanimous opinion finding the corporation excise tax passed by the last Legislature constitutional. This tax is one of 3 per cent upon the net earnings of corporations doing business wholly within the state, including electric light and power companies. The suit to test its constitutionality was brought against the state by the Bank of Commerce & Trust Company and others.

The court denied that the law set up unequal methods of taxation, pointing out that the constitution indicated two objects and modes of taxation—property, taxed equally upon its value, and privileges, taxed and classified at the discretion of the Legislature. The excise tax was construed to be a privilege tax. To the contentions that the act arbitrarily taxes corporations to the exclusion of partnerships and individuals in competing activities, allows deductions to corporations engaged in interstate commerce to the exclusion of those doing business wholly within the state, taxes corporations whose activities produce net earnings and exempts those which make no profit, measures the tax on insurance companies by a scale different from other corporations and taxes all members of the class without regard to the privilege enjoyed, the court rejoined that the Legislature has power to select and classify the subjects of indirect taxation, provided the classification rests upon reasonable and substantial distinctions growing out of prevalent economic or social conditions or the diverse nature of the business carried on. The court recited the various kinds of companies that are to be taxed and said that none was arbitrarily included or excluded.

Discussing net earnings, the court held that the Legislature could have given the term a statutory definition, but since that was not done the phrase must be given its usual and ordinary meaning, without any forced or subtle construction.

Studebaker System Grows

Kansas Public Service Company Organized—Missouri, Oklahoma and Ohio Territory

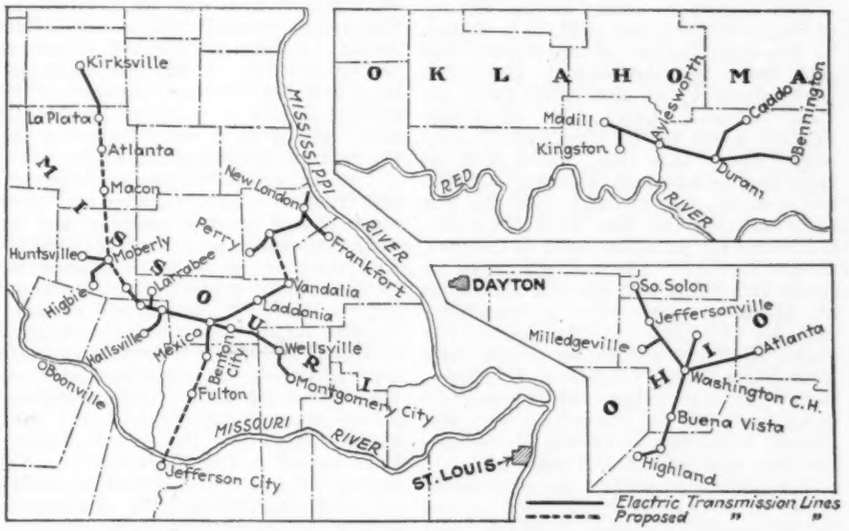
OFFICIAL announcement of the merger of numerous public utility properties in Kansas under the control of one company to be known as the Kansas Public Service Company, with assets of more than $13,000,000, has been made by the Illinois Power & Light Corporation, which owns the companies affected by the consolidation and operates in more than 350 cities and towns of five states in the Mississippi Valley. The Kansas Power & Light Company has also been formed to build the power plant at Tecumseh already announced and transmission lines in Kansas, among them the line from Topeka to Atchison.

Under the new arrangement the Topeka Railway & Light Company changes its name to the Kansas Public Service Company and takes title to the property of the Atchison Railway, Light & Power Company and the Wichita Railway & Light Company. It will as formerly own all the stock of the Topeka Edison Company and the Topeka Railway Company and in addition purchase all the common stock of the Kansas Power & Light Company. Clement Studebaker, Jr., will be president of the Kansas Public Service Company, and William A. Baehr, H. L. Hanley and Scott Brown will be vice-presidents.

Growth in Other States

These officers are also those of another McKinley-Studebaker company whose organization was recently reported in the ELECTRICAL WORLD—the Missouri Power & Light Company, which owns and operates directly or through subsidiaries electric power and light and other properties in forty-nine cities and towns of Missouri, Ohio and Oklahoma. This takes in all of the properties of the old Missouri Utilities Company in Missouri, all of the properties of the North American Light & Power Company in Oklahoma and Ohio, and in addition the properties of the North Missouri Light & Power Company, the Jefferson City Light, Heat & Power Company, and some utilities of other kinds.

Among the first improvements to be made in Missouri will be the building of a transmission line from Auxvasse to Jefferson City, thereby completing a line from the capital city to Mexico, and the building of a line from Clark to Moberly and on through to La Plata, making a line clear through from Kirksville to Mexico.



ILLINOIS POWER & LIGHT SYSTEMS IN THREE STATES

Electric light and power companies affected by the organization of the new concern are: In Missouri, Adair County Light, Power & Ice Company, Missouri Heat, Light & Power Company, La Plata Light, Heat & Power Company, Huntsville Light & Power Company, Boonville Light, Heat & Power Company, Citizens' Electric Light Company, Moberly Light & Power Company, North Missouri Light & Power Company and Jefferson City Light, Heat & Power Company; in Oklahoma, Consumers' Light & Power Company, in Ohio, Washington Gas & Electric Company.

Public utility service in twenty-four towns in Missouri is affected. They are Mexico, Jefferson City, Centralia, Candalia, Wellsville, Sturgeon, Ladonia, Martinsburg, Clark, Hallsville, Perry, Benton City, Montgomery, Thompson, Center, Frankfort, New London, Boonville, Higbee, Huntsville, Kirksville, La Plata, Moberly and Jefferson City. The Ohio towns affected are Washington Court House, Staunton, Buena Vista, Leesburgh, Highland, New Holland, Atlanta, Bloomingburg, Milledgeville, Jeffersonville and South Solon.

More Interconnection

Adirondack Power & Light and New York State Gas & Electric Enter Agreement

BY THE terms of a contract just signed between the New York State Gas & Electric Corporation and the Adirondack Power & Light Corporation the former company will henceforth draw upon large supplies of hydro-electric power generated by the latter. The contract, which is for ten years, gives to the New York State Gas & Electric and its subsidiaries an added source of supply which will enable them to develop to the maximum the service made possible by recent acquisitions of local utility properties in the southern tier of New York State. With transmission lines to be built this year and subsequently, by which the amount of power contracted for will gradually be increased, about $2,500,000 is involved in the contract.

The immediate sequel to the closing of the power contract will, it is stated, be the construction of a transmission line from the Adirondack Power & Light property at Beardsley Falls, on East Canada Creek, in Herkimer County, south to the Herkimer County line. There this line, which will be built by the Adirondack Power & Light Corporation, will connect with the line to be built by the New York State Gas & Electric Corporation south to Colliers, Otsego County. The entire line, to be ready this year, will carry a maximum of 114,000 volts with a maximum capacity of 15,000 kw. At Colliers the plans call for a substation of the New York State Gas & Electric Corporation, where the high voltage will be stepped down to 44,000 for connection with the present transmission system of the corporation and its subsidiaries.

The plans also embody the connecting up of all the utility properties acquired in Delaware, Madison, Sullivan and Otsego Counties. The initial expenditure for this purpose will amount to $750,000.

From Colliers a transmission line will connect with the properties at Liberty, Sullivan County, taking in Delhi, in Delaware County. The effect will ultimately be a power trunk line from the Adirondacks to the coal fields of Pennsylvania.

The Public Service Commission has approved the construction and exercise of franchises by the New York State Gas & Electric Corporation in the villages of Laurens, Milford, Richfield Springs, Deposit, Walton, Hancock, Margaretville and Fleischmanns and in twenty-six adjoining towns.

Idaho and Utah Holding Companies May Merge

It is reported that the Power Securities Corporaton—holding company for the Idaho Power Company, the Boise Valley Traction Company and the Nevada Power Company—and the Utah Securities Corporation—holding company for the Utah Light & Traction Company, the Utah Power & Light Company and the Western Colorado Power Company—may be consolidated. Both public utility groups are under the financial supervision of the Electric Bond & Share Company of New York City.

Southern California Edison's Achievements and Plans

By the Southern California Edison Company's Big Creek-San Joaquin River project, with additional steam reserve, its generating capacity will eventually be increased by 2,250,000 hp., said President John B. Miller in addressing the recent annual stockholders' meeting. The company's present capacity is 500,000 hp. Energy to the amount of 130,000 hp. was developed from the Big Creek-San Joaquin River project last year. Auxiliary steam power to maintain the equilibrium between water and steam generation, amounting to 132,000 hp., will be added in the present year.

During the year 17,529 stockholders were added, bringing the total number up to 65,636. New business amounting to 219,046 hp. was contracted for. Customers added numbered 54,400, making a total of 248,000 consumers served directly from the company's lines and 150,000 more through energy sold wholesale to municipalities for resale. The present rates are lower than the rates prevailing prior to the war.

The 1924 budget appropriation for construction of water-power and steam stations and for transmission and distribution will amount to $26,288,000. The company expects to finance this by the sale of preferred stock amounting to $8,000,000, which will enable it to sell bonds amounting to approximately $18,000,000. The chief construction activities in immediate view are the extensive addition to the company's steam-power auxiliary and forcing to rapid completion the great Florence Lake tunnel in the High Sierras. This tunnel will be completed about February, 1925, and will provide an additional 600,000 hp. of water-generated energy.

Gennevilliers Station to Install High-Pressure Boilers

Four Ladd-Belleville boilers have just been ordered from the Delaunay-Belleville shops at St. Denis for installation in the Gennevilliers power station at Paris, where Babcock & Wilcox and Stirling boilers now serve 40,000-kw. generators. These new boilers will each have 1,830 sq.m. (about 18,000 sq.ft.) of heating surface and will operate at pressures up to 28 kg. per square centimeter (about 400 lb. per square inch). This, Technical Director Money declares, is the maximum pressure imposed on French boiler makers up to the present time.

So far the Gennevilliers station has not been using pressures of more than 25 kg. per square centimeter (about 350 lb. per square inch). The new Ladd-Belleville installation will be utilized in connection with an additional 40,000-kw. generator. Zoelly turbines only are used at the Gennevilliers plant, and so far there are five Zoellys installed, each delivering nominally 40,000-kw. The Ladd-Belleville addition marks an approaching increase in the output of this station to 240,000 kw. Eventually the Gennevilliers station will attain to 300,000 kw. With its supplementary plants it will then be in a position to furnish a total of 400,000 kw. This power will be disposed of largely to industrial works.

The Delaunay-Belleville shops are now turning out both Belleville boilers of the original horizontal type and the vertical Ladd-Belleville. The horizontal boiler was modified in 1913 and improved after the war. As so modified it is applicable for units of moderate power having a steam production of 15,000 kg. to 20,000 kg. (33,000 lb. to 44,000 lb.) per hour. For more powerful units recourse is had to the Ladd-Belleville boiler. Pulverized fuel is contemplated for the new installation.

Interconnection to Be Topic at Wisconsin Convention

Interconnection of electric power systems, reasons why public utility companies should sell appliances, electrical distribution problems, a uniform policy concerning discontinuance of service to customers, and accounting procedure for smaller utilities, will be the leading topics at the Wisconsin Utilities Association convention at the Hotel Pfister, Milwaukee, on April 17-18. The morning sessions will be devoted to general papers by leaders in the utility field, and group discussions are scheduled for the afternoon. The annual banquet will be held on Friday evening, April 18. The tentative program is in part as follows:

THURSDAY, APRIL 17

Morning.—"State Ownership and Operation of Water Powers," by Halford Erickson, vice-president Byllesby Engineering & Management Corporation; "The Right to Occupy the Highway," by Adolph Kanneberg, Railroad Commission of Wisconsin.

Afternoon.—Electric Section: "Wired Wiresless," C. C. Jackson, Westinghouse Electric & Manufacturing Company; report of studies conducted under the electrical fellowship—"Experiments with Wave Filters"; "Tests on the Fynn-Weichsel Type of Motor," by Prof. Edward Bennett and R. E. Johnson, University of Wisconsin; "Interconnection of Electric Power Systems," discussion led by G. C. Neff, Great Lakes Division, N. E. L. A.; "Recent Developments in Administering the Electrical Safety Code," C. B. Hayden, Railroad Commission, and John A. Hoeveler, Industrial Commission. Sales Section: "Why Public Utility Companies Should Merchandise," F. E. Hazard; "How and When Sales Campaigns Should Be Conducted," R. S. Rodenhuis. Accounting Section: Report on "Uniform Disconnect Policy," J. E. Gray; routine accounting procedure, discussion led by L. H. Boutell; report on accounting procedure for smaller utilities, Karl F. McMurry; "Safeguarding Business Records," E. M. Hawes; round-table discussion on the application of the present classification of accounts for Class A and B gas and electric utilities, led by H. H. Wilson, Railroad Commission.

FRIDAY, APRIL 18

Morning.—"Freight Charges and Steam Railway Transportation Problems Affecting Public Utilities," F. M. Elkinton, Milwaukee; address, John F. Gilchrist, vice-president Commonwealth Edison Company; "Public Utility Research and Land Utilization," Dr. Richard T. Ely, director Bureau of Land Economics and Public Utilities; report on the enlarged program of the Wisconsin Public Utilities Bureau, by J. P. Pulliam; "Service the Watchword of Business," W. S. Vivian, Middle West Utilities Company.

Afternoon.—Electric Section: Report on pole identification, E. J. Kallevang; report on rural lines, R. G. Walter; "Recent Developments in the Steam-Turbine Field," E. J. Brown, Allis-Chalmers Company; "Some Innovations in Electric Distribution," S. B. Hood, Northern States Power Company. Sales Section: "Encouraging Employees to Report 'Prospects' to the Commercial Department," J. E. Newton; "The Electric Sign as a Desirable and Profitable Source of Revenue," E. A. Lambert.

Electric Power Club Issues Code of Ethics

The "Code of Ethics of the Electric Power Club" is just off the press. This code has been largely compiled from selected abstracts of papers presented at meetings of the Electric Power Club, edited in the light of changes which have taken place in the industry during the intervening years and the conditions which obtain today. The code concerns itself principally with the relations of manufacturers to their customers and the interrelation of manufacturers among themselves in matters especially relating to the commercial function, thus supplementing the existing codes relating to the technical and engineering departments of the industry.

The pamphlet consists of four divisions: "General Principles," "Relations of Manufacturers to Customers, Agents or Others," "General Relations of Manufacturers to Each Other" and "Relations of Manufacturers to Each Other in Selling." Among practices condemned are "attempts to standardize to such a point as to discourage or limit the development of the industry," efforts to reopen or disparage a contract awarded to a competitor, broad statements as to the superiority of direct current over alternating current or vice versa, indiscriminate commissions, appropriation of specific non-patentable designs developed by a competitor, institution of patent suits based on mere technicalities, unfounded criticism or insincere compliment concerning a competitor's apparatus (clear-cut, truthful comparisons being, however, justified), and presents or gratuities to customers with the intent of influencing orders.

Annual Reports Continue to Show Gains

The Southern California Edison Company's annual report for 1923 shows total assets of $188,975,537; current assets including $1,427,302 cash were $9,712,491 and current liabilities $9,445,058; profit and loss surplus was $3,393,008. Income account compared with 1922 as follows:

	1923	1922
Gross earnings	$20,211,160	$16,982,225
Operating expenses and taxes	8,886,471	6,663,369
Net earnings	$11,324,689	$10,318,856
Net income	5,153,639	4,465,577
Surplus	853,803	758,998

The Niagara, Lockport & Ontario Power Company reports a gross revenue from sales in 1923 of $5,550,258 and a net revenue of $2,606,555 for itself and the operating companies subsidiary to it. These figures compare with $4,158,994 and $2,047,170 in 1922. Net income last year after all deductions was $935,903 and surplus was $322,668. A total of 613,547,320 kw.-hr. was generated, as compared with 484,877,202 kw.-hr. last year.

The Oklahoma Gas & Electric Company made greater progress in 1923 than in any previous year in its history. Both gross and net earnings were the largest on record, the former amounting to $7,075,435 and the latter to $2,227,380. After all operating expenses, taxes, interest on funded debt and dividends on the preferred shares, the company had a balance of $657,226 available for depreciation, amortization and return on capital invested.

Briefer News

Portland (Ore.) Central Station Company to Change Name.—The Portland Railway, Light & Power Company of Portland, Ore., which is issuing $7,500,000 of 6 per cent first preferred stock and reorganizing its financial structure, will change its name to Portland Electric Power Company.

Long Island Railroad Electrification.—The completion of the electrification of the Montauk division of the Long Island Railroad, which is a subsidiary of the Pennsylvania and serves Queens Borough in New York City as well as the rest of the island, is set for May, 1925. This suburban division runs from Jamaica to Babylon, and the undertaking will cost about $4,000,000.

Southeastern Water and Light Association.—The fourteenth annual meeting of this association, which is composed of representatives of municipal water and light commissions in Georgia, North and South Carolina, Florida, Alabama, Mississippi and Tennessee and is the outgrowth of the former Tri-State Water and Light Association, will be held in Atlanta on April 15 to 17.

Fitkin Interests Acquire Arkansas-Missouri Power Company.—The Arkansas-Missouri Power Company, which supplies the territory in southeast Missouri and northeast Arkansas within a radius of 60 miles of Caruthersville, Mo., was taken over last month by A. E. Fitkin & Company, New York. This is an addition to the large group of utility companies owned by the Fitkin interests in Kansas, Texas, Michigan, Missouri, New Jersey, North Carolina and Florida. A program of expansion will be carried out.

De Forest Radio Lectures at Yale.—Various aspects of radio development are being covered in the lecture course established at Yale University through the generosity of Dr. Lee de Forest. Among the lecturers have been or will be Dr. Harold W. Nichols, Western Electric Company; Ralph Bown, American Telegraph & Telephone Company; L. E. Whittemore and Dr. J. H. Dellinger, Bureau of Standards; Dr. George W. Pierce, Harvard University, and Commander Donald C. Bingham, U. S. N.

Pacific Gas & Electric Sets Aside Lands for Park.—The Pacific Gas & Electric Company has transferred to the State of California 175 acres of land on the Pit River, in the northern part of the state, for park purposes. The dam for the company's Pit River No. 3 development now under construction will back the waters of the river up and form a large lake within the park area. The region abounds with timber, waterfalls and natural scenery and is adjacent to Mount Lassen National Park.

Potomac Edison's Cumberland Plant Not Damaged.—The severe flood in Cumberland, Md., last week caused no damage to the plant and system of the Potamac Edison Company in that city other than the accumulation of flood-water refuse in the basement of the main power-station building. The main generating equipment was not reached by the water, and electric service was restored as fast as the flood deposit could be removed.

Personnel of St. Lawrence Engineering Board.—The Secretary of War has designated Col. Edgar Jadwin, Col. William Kelly and Lieut.-Col. George B. Pillsbury as the American members of the international engineering board which will revise the estimates contained in previous reports on the St. Lawrence River. This work is to be done under the direction of Secretary of Commerce Hoover, who is the chairman of the St. Lawrence commission appointed recently by the President. The other three members of the board are Canadian engineers.

Wyoming Utilities Association Convention.—The annual convention of the Wyoming Utilities Association will not be held until after the N. E. L. A. convention at Atlantic City, according to Secretary H. C. Chappell of the Wyoming association, and, if present plans prevail, the convention, which will also include a quarterly meeting of the Rocky Mountain Geographic Division of the N. E. L. A., will be held in the new office building of the Natrona Power Company at Casper, Wyo. The original announcement that the convention would be held in Cheyenne on May 5-7 is thus superseded.

Missouri River Hydro-Electric Project in South Dakota.—Great interest is being taken in towns along the Missouri River in South Dakota in a project to develop the water power of the big bend in the river about midway between Pierre and Chamberlain. Here the Missouri makes a sweep of about 40 miles and comes back within a mile and a quarter of its former course. The fall in that distance is about 21 ft., and the assertion is made that 16,000 hp. could be developed in units of 4,000 hp. as needed and sold over a radius of 75 miles for 1 per cent per kilowatt-hour.

Two Municipal-Ownership Proposals Defeated, One Carries.—The electors of Chippewa Falls, Wis., have defeated the proposal to purchase the electrical distribution system of the Wisconsin-Minnesota Light & Power Company in that city by a vote of 1,512 to 641. At Fergus Falls, Minn., a proposal to issue $600,000 in bonds for the erection of a city-owned power plant was also overwhelmingly defeated. In Grand Forks, N. D., however, the voters stood 3,246 for and 1,416 against a proposal to build a municipal lighting plant at

a cost of $110,000. Chippewa Falls has a population of 9,000, Fergus Falls of 7,500 and Grand Forks of 14,000.

California Commission Cuts Midland Counties Rates.—The California Railroad Commission has established new electric rate schedules for the Midland Counties Public Service Corporation, which utility supplies electricity in Coalinga, Paso Robles, San Luis Obispo, Santa Maria, Arroyo Grande, surrounding territory and intervening towns. The commission found that the Midland Counties was earning 9.22 per cent upon a reasonable valuation. It established rates which will reduce the return to slightly below 8 per cent and which are equivalent to those charged by other light and power companies in that part of California.

Colorado Springs Vote Postponed.—Submission to the voters of the Colorado Springs ordinance authorizing a bond issue of $1,250,000 for a municipal electric light plant has been postponed until May 20. It is said that 250 business and professional men of the city are opposing the proposal so actively that there is an even chance of its defeat. Colorado Springs papers charge that the City Council is attempting to mislead the taxpayers, since its favorable report is based on the recommendation of the late George Anderson, which concerned only water power, whereas the funds requested are based on the Wood survey, which involves a steam stand-by plant.

Stokers at Hell Gate Have Fourteen Retorts.—In a news item on page 638 of the ELECTRICAL WORLD, March 29, concerning tests on boilers of new design at the Hell Gate plant of the United Electric Light & Power Company, New York, it was inadvertently said that the Taylor underfeed stokers employed had seven retorts. As a matter of fact, they are much larger, being of type "H," fourteen retorts wide and thirty-three tuyères deep. The American Engineering Company has received an order for three more of these stokers for installation at the Hell Gate power station.

Pueblo Company Plans Improvements.—The new construction program for 1924 of the Southern Colorado Power Company calls for an expenditure of approximately $400,000, which includes new boilers and other improvements at Canyon City, reconstruction of power lines and additional transformers for the main steam plant at Pueblo.

Plan to Floodlight Inner London.—A scheme looking toward the flooding of the whole inner area of London with artificial moonlight after nightfall will be brought before the Institute of Public Lighting Engineers. The plan calls for electrically floodlighting the city by means of eight powerful groups of projectors, which would surmount steel towers, 500 ft. high, distributed over a wide area. Adoption of the scheme, it is said, would result in better lighting and make London practically shadowless, as well as cut the cost of illuminating the city's 2,223 miles of streets, which at present is almost £1,000 nightly.

"Franklin Fund" a Hoax.—The story of awards to the late Charles P. Steinmetz and others for contributions to curative science, these awards being said to be the first made from a fund alleged to have been established by Benjamin Franklin in 1759 and to have accumulated ever since, is now asserted to be a hoax, and a Los Angeles man has come forward to say that he concocted the clever if reprehensible fraud to win a bet. According to cable dispatches, the London *Times* and the *British Medical Journal*, which made themselves responsible for the original announcement, did so on the strength of advices received by London mail bearing no street address and were quite unable to verify the story when they made a tardy attempt to do so.

New York's Annual Electric Truck Show.—More than four hundred trucks are expected to take part in the parade which marks the opening of the fourth annual electric truck show in New York City on April 19. Immediately after the parade disbands the show, which will be held in the Irving Place showroom of the New York Edison Company, will officially be opened. This show, which numbers among its exhibitors every manufacturer represented in the metropolitan territory, will continue for one week. Besides the trucks, batteries, garage accessories and charging equipment will be shown. There will be a luncheon on Wednesday April 23, informal discussions of local traffic problems will take place on several evenings during the week, and each day of the show will be designated for some industry and the service of electric trucks in that industry.

Indiana Commission Declines Jurisdiction Over Issues for Flat Rock Development. — In accordance with an opinion submitted to the Indiana Public Service Commission recently by the Attorney-General of the state to the effect that a company is not a public utility under jurisdiction of the commission until it owns, operates or leases public utility property, the commission has declined to assume jurisdiction over the proposals of the Hoosier Hydro-Electric Company and of the Flat Rock Hydro-Electric Company to issue securities. They have no public utility property. The Hoosier company asked to issue $1,500,000 of securities and the Flat Rock company asked to issue $50,000. Both companies contemplate developing the water power of Flat Rock River, near St. Paul, Ind.

Annual Report of Dominion Water Power Branch.—The Dominion Water Power Branch of the Department of the Interior of Canada has recently issued its annual report for the fiscal year ended March 31, 1923. This report briefly describes the main lines of activity which are pursued by that organization in investigating the water resources of Canada and administering the Dominion water powers. The method of co-operation with provincial authorities in the making of a Dominion-wide survey of water and water-power resources and the scope of this work during the year under review are outlined; tables showing the available and developed water power in Canada and the quantity of water power used in the central-station and pulp and paper industries as of February 1, 1923, are given, as is also a list of hydro-electric activities in 1922.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

Southeastern Water and Light Association—Piedmont Hotel, Atlanta, April 15-17. W. F. Steiglitz, Columbia, S. C.

Wisconsin Utilities Association—Hotel Pfister, Milwaukee, April 17-18. J. N. Cadby, 445 Washington Bldg., Madison.

Southwestern Division, N. E. L. A.—Hotel Grunewald, New Orleans, April 22-25. S. J. Ballinger, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 22-25. E. N. Willis, Dallas, Tex.

American Electrochemical Society—Hotel Bellevue-Stratford, Philadelphia, April 24-26. Colin G. Fink, Columbia University, New York City.

American Physical Society—Washington, April 25-26.

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

Pacific Coast Electrical Association—Hotel del Coronado, San Diego, Cal., May 17-20.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—Chicago, May 22-23. F. P. Vose, 1347 Marquette Bldg., Chicago.

American Society of Mechanical Engineers — Spring meeting, Cleveland, May 25-29. C. W. Rice, 29 West 39th St., New York.

Electric Power Club — Seaview Golf Club, Absecon, N. J., May 26-29. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Electrical Supply Jobbers' Association—Homestead Hotel, Hot Springs, Va., June 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Pacific Coast Electrical Association—Hotel Coronado, Coronado, Cal., June 17-20. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Empire State Gas and Electric Association—Commercial Section, Buffalo and Niagara Falls, June 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

American Institute of Electrical Engineers — Annual convention, Edgewater Beach (Chicago), June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Associated Manufacturers of Electrical Supplies—Hotel Ambassador, Atlantic City, N. J., June 24-27. Frederic Nicholas, 30 East 42d St.

Society for the Promotion of Engineering Education—University of Colorado, Boulder, Col., June 25-26. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Iowa Water-Power Sites.—A bill has been passed by the Iowa House of Assembly which imposes a permit fee of $100 on water-power sites in the state in addition to an annual inspection fee of $25. The object is to force owners of these sites to develop them or relinquish them to others who will. About 200,000 hp. of water power remains undeveloped in Iowa, while apart from the Keokuk plant only 18,600 hp. has been utilized. This amount is generated by plants scattered over the state, of which the largest is rated at only 1,800 hp.

Interstate Public Service Plans.—Plans for a 23-mile, 66,000-volt transmission line from Connersville, Ind., to the Ohio state line have been made by the Interstate Public Service Company. Power will be supplied by the Union Gas & Electric Company of Cincinnati. The Interstate has recently completed several hydro-electric units on the Whitewater Canal at Connersville, has built a transmission line from New Albany to Corydon, discontinuing the plant at the latter place, and has put into service a new. 3,500-kw. steam turbine at Goshen. The company is also completing a 33,000-volt line from Goshen to Warren and has accepted plans for a 33,000-volt line from Bloomington to Elletsville. All the places named are in Indiana. The half-million-dollar 66,000-volt line from Jeffersonville to Scottsburg and from Scottsburg to Bedford is to go forward this year and, as previously announced, will take power from the Louisville Gas & Electric Company and the hydro-electric plant the Kentucky Utilities Company is building on Dix River.

Electrical Expansion in Michigan.—Besides the 100,000-kw. installation of the Detroit Edison Company at Trenton Channel, to go into service about May, and its 3,600-kw. hydro-electric plant at French Landing, on the Huron River, with their extensive new networks, and the heavy building program of the Consumers' Power Company in central and southern Michigan, noted in the ELECTRICAL WORLD for February 23 (page 396), there is no little activity in other districts of the state. The Indiana & Michigan Electric Company, for instance, which serves a number of cities in southern Michigan, is planning to increase its generating capacity with two 35,000-kva. units. Eight miles of transmission line on steel towers is to be built. Alpena is to be served this year from a new power dam at Norway Point on the Thunder Bay River. A 5,000-kva. unit will be installed and a 6-mile, 33,000-volt transmission line built. Among smaller items, new equipment will be installed at Frankfort by the Benzie County Power Company; the Michigan United Light & Power Company of Ludington plans to build 18 miles of 6,600-volt transmission line, and plans are under consideration for a 1,000-kw. auxiliary steam plant at Boyne City to protect service against periods of inadequate water supply. Extension of service to farmers is responsible for a considerable part of the expansion program in the state.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

H. H. Couzens Goes to Brazil

H. H. Couzens, general manager of the Toronto Hydro-Electric System and of the Toronto Transportation Commission, has been appointed vice-president of the subsidiary companies of the Brazilian Traction, Light & Power Company, controlled by Canadian interests. Mr. Couzens has been identified with the Toronto Hydro-Electric System since 1913, when he resigned as general manager and electrical engineer of the Corporation of Hampstead, London, England, to become its general manager. In the fall of 1921 the city of Toronto took over the local railway lines and Mr. Couzens assumed his present duties on the transportation commission.

H. H. COUZENS

Mr. Couzens was born in England in 1877 and received his education at Independent College at Taunton. Subsequently he served as a pupil in mechanical and electrical engineering with Allen & Sons, Taunton, and the Taunton Corporation Electrical Works. After holding a number of engineering positions he became manager and engineer of the West Ham Corporation Electric Supplies in 1909, in which capacity he served for three years. At the end of that period he joined the Corporation of Hampstead, resigning to affiliate himself with the Toronto system. As vice-president of the Canadian holding company Mr. Couzens will make his headquarters in Rio de Janeiro.

Frederick Bedell, formerly a vice-president of the American Institute of Electrical Engineers and professor of applied electricity at Cornell University, recently made a twelve-thousand-mile motor camping trip completely around the rim of the United States. Various engineering projects, including the Roosevelt and Shoshone dams, were visited. Dr. Bedell is a frequent contributor to the ELECTRICAL WORLD.

Chester A. Briggs, auditor of the Knoxville (Tenn.) Power & Light Company, has been elected secretary of the company. Mr. Briggs will continue to perform the duties of auditor.

William Insull, formerly manager of the Connersville (Ind.) district of the Interstate Public Service Company, has been appointed manager of the Lafayette district of the Northern Indiana Gas & Electric Company. Mr. Insull is succeeding B. H. Gardner, recently transferred to Hammond.

S. B. Williams, at present the editor of the *Electrical Record*, will become editor of the *Electragist*, published by the Association of Electragists, New York, succeeding Farquson Johnson, who is resigning to engage in newspaper promotion work. Mr. Williams brings to his new office a background of wide experience covering many years' association with the electrical press. Previous to joining the staff of the *Electrical Record* he had been with the ELECTRICAL WORLD continuously since his graduation from Princeton as an electrical engineer in 1914, and during that period he had served as editorial representative, statistical editor, commercial editor and news editor. At the time of his resignation he was assistant managing editor. He will assume his new duties on May 1. Mr. Johnson, whom Mr. Williams is succeeding, has been editor of the *Electragist* for more than four years and for two years served as the secretary-treasurer of the association.

Stanley A. Dennis, who has been editor of *Electrical Retailing*, published in Chicago, has been selected to be editor of the *Electrical Record*, succeeding S. B. Williams, resigned. Mr. Dennis was for four years associate editor of *Electrical Merchandising*. The experience Mr. Dennis has obtained in his various editorial positions is reinforced by a highly specialized knowledge of merchandising problems gained while he was director of the bureau of business standards of the A. W. Shaw Company.

H. W. Foote, for the past five years superintendent of the northern division of the Alabama Power Company, Huntsville, Ala., has been transferred to the eastern division at Anniston, Ala.

L. T. Smith, Jr., recently of the Dixie Construction Company, has been made superintendent of the northern division of the Alabama Power Company, Huntsville, Ala., succeeding H. W. Foote, who has been transferred to the eastern division at Anniston.

Ira R. Seltzer, president and general manager of the Gordon Electric Manufacturing Company, Waterville, Conn., for the past seven years, will resign and dispose of most of his interests in the organization, effective May 1. Mr.

Seltzer purchased the company in Chicago in 1917 and after operating there for one year he moved the entire plant to Waterville, where under his guidance it has developed remarkably. Mr. Seltzer is planning to go to the Pacific Coast following his resignation from the Gordon company.

James Link, formerly chief engineer of the Knoxville (Tenn.) Power & Light Company, has been appointed superintendent of the electric department of the company.

Fred Roach, formerly line superintendent of the Monticello (Ind.) district of the Interstate Public Service Company, has become manager of the Aurora (Ind.) territory of the company.

Robert C. Scott, formerly connected with the Union Gas & Electric Company, Cincinnati, is now electrical designer with Stone & Webster, Boston.

G. H. Pythian, contracting engineer of Chicago, has been placed in charge of the construction of the new plant of the Mountain States Power Company at North Bend, Ore.

W. B. Wallace, formerly manager of the credit department of the Western Electric Company at Atlanta, assumed the duties of assistant treasurer of the company on April 1, with headquarters in New York.

R. J. Miller, who was formerly securities manager of the Wisconsin Power, Light & Heat Company in Dodge County, has resigned.

Gordon H. Day, who until recently was associated with the engineering division of the Pierce Arrow Motor Car Company, has affiliated himself with the Utica (N. Y.) Gas & Electric Company.

Harold L. Ethridge, formerly assistant electrical engineer New York Central Lines and more recently with the Cleveland Union Terminals Company, has joined the electrical division of Stone & Webster, Inc., Boston.

Earl R. Evans has severed his connection with the North Electric Manufacturing Company to enter the patent department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

A. R. Thompson, formerly superintendent of the municipal light plant at Independence, Mo., has become superintendent of Montgomery, Ward & Company's plant in Kansas City.

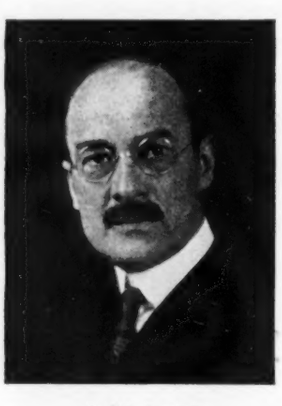
Isaac Harter, for many years general superintendent of the Babcock & Wilcox Company, New York, has been made vice-president of the company to succeed A. G. Pratt, recently promoted to the presidency.

Leo Shapiro, who was formerly with the Wagner Electric Corporation, St. Louis, is now associated with the Central Illinois Public Service Company, Springfield, Ill., as field engineer in the department of transmission and distribution.

H. F. Hoxie has been appointed general manager of the A. E. Fitkin & Company properties in southeast Missouri and northeast Arkansas, succeeding F. Y. Low, who has severed his connection with the company. Mr. Hoxie has been general field manager in certain of the Fitkin territories for some time.

Samuel M. Stone, President and Directing Head of Johns-Pratt Company

Samuel M. Stone, who assumed active management of the Johns-Pratt Company upon the recent retirement of Arthur W. Fox, has been president of the company since 1922. At that time the Colt Patent Fire Arms Company, with which he was identified, purchased the Johns-Pratt Company, and he was chosen chief executive of the latter organization. Mr. Stone has been associated with the Colt Patent Fire Arms Company for nineteen years, beginning as salesman and advancing after two years' service to the position of sales manager. In 1912 he was made vice-president of the company, and three years ago when Colonel William C. Skinner asked to be relieved of the



S. M. STONE

duties of president Mr. Stone was elected to succeed him. He was born in Urbana, Ohio, was educated in the public schools of that city, and previous to his connection with the Colt company was for fifteen years buyer for the Simmons Hardware Company of St. Louis. In addition to being chief executive of the Colt company and the Johns-Pratt company, Mr. Stone has various other connections, including a directorship in the Hartford Electric Light Company and in many other commercial enterprises.

A. G. Pratt, formerly vice-president of the Babcock & Wilcox Company, New York, has been selected to succeed in the office of president of the company W. D. Hoxie, who has been made vice-chairman of the board of directors.

C. A. Kittredge has been made division superintendent of the southern division of the Alabama Power Company, Montgomery, Ala. In this capacity Mr. Kittredge has charge of the operation and maintenance of high-tension substations and lines.

George E. Flannigan has resigned his position as director of publicity and public relations of the western division of the Public Service Company of Colorado, at Boulder, to become secretary of the retail merchants' bureau of the Denver Civic and Commercial Association. Mr. Flannigan was formerly secretary of the Colorado Public Utilities Commission.

Howard Pett, district superintendent of the Consumers' Power Company at Jackson, Mich., has been promoted to the position of district manager to succeed John K. Swanson, recently transferred to Saginaw.

L. M. Shreve has been appointed acting manager of the Washington Coast Utilities Company at Wenatchee, succeeding O. M. Carter, recently transferred to Stanwood. Mr. Shreve has been identified with the company and its predecessors for more than sixteen years.

William Earl McCreery of the sales department of the Paducah (Ky.) Electric Company has been appointed sales manager of the Keokuk (Iowa) Electric Company, succeeding William H. McInnis, who has been transferred to Halifax, N. S. All these properties are under the executive management of Stone & Webster, Boston.

E. E. Howard has recently been made head of the investment department of the Interstate Public Service Company, Indianapolis. A salesman for more than thirty years, Mr. Howard has conducted throughout the country unusually successful sales campaigns in electrical appliances. Recently he has been devoting his attention especially to the banking and investment business.

Chester A. Norton has been appointed New England district manager of the Westinghouse Lamp Company, with headquarters at Boston, succeeding C. S. Davis, who has retired from this post after many years of service. Mr. Norton's appointment was effective April 1. For the past two years he has been assistant to the sales manager of the lamp company, with offices in New York City, and prior to coming East he served eight years on the Pacific Coast, attaining the post of manager of the Seattle office. Before that he was engaged in general sales work for five years on the Coast with the Westinghouse Electric & Manufacturing Company.

Obituary

John E. Barhite, public service commissioner of New York State from 1917 to 1921, died on Wednesday, April 2, at his home in Rochester after an illness of six months.

Thomas Alfred Wynne, for sixteen years vice-president and treasurer of the Indianapolis Light & Heat Company, died on March 26 after an illness of two years. Death was due to pernicious anemia. Mr. Wynne was born in Ottawa, Canada, in 1866, but at an early age came to the United States. In 1887 he joined the Jenny Electric Company, Indianapolis, and subsequently became superintendent of construction for the Marmon-Perry Light Company, with which C. C. Perry, now president of the Indianapolis Light & Heat Company, was associated. In 1888 Mr. Wynne assisted Mr. Perry in the organization of the Indianapolis Light & Power Company, which in 1905 became the Indianapolis Light & Heat Company.

Commission Rulings

Salaries of Sole Owners.—A contention by utility patrons that salaries paid to the sole owner of a utility plant and his wife should be taken and considered as a part of the fair return was disapproved by the Maine Public Utilities Commission in a water-company rate case in which it was put forward. The commission said: "Reasonable salaries paid to officers or employees of a public utility are no part of the 'fair return' which the utility is entitled under the law to receive. Such salaries are a part of the operating expenses of the utility. The fact that the person receiving such salary happens to be the owner of its stock and bonds makes no difference in this respect."

Burden of Proof in Rate Cases.—Asserting that where the uncontroverted evidence indicates that the income from the new rates will not produce greater fair return than the respondent is entitled to receive upon its property employed in the public service a rate complaint will be dismissed, the Pennsylvania Public Service Commission dismissed complaints against the charges of the Topton Electric Light & Power Company. The complainants did not offer any testimony and rested their complaints on the contention that the company had not met the burden of proof imposed on it to establish that the increased rates were just. The commission held that the company had done this, saying: "After reducing respondent's valuation to a minimum under the evidence and likewise eliminating from the operating expenses all questionable items, the fact remains, as established by the testimony, that the rates complained against will not produce, under existing conditions, more revenue than respondent is entitled to receive."

Structural Overhead Expense Not a Part of Value of Physical Property.—Estimates of structural overheads are a part of estimates of reproduction and as such are justified by common-sense knowledge that in such a construction such expenses in some amount would necessarily be incurred, declared the Indiana Public Service Commission in discussing rates for the Indianapolis Water Company. "But," it continued, "no one who knows his subject contends that this is an intangible asset to be added to the value of the physical property. The difficulty is that the meaning of the estimated appraisement and the value as found are confused in the mind. Such costs in connection with construction are as much a part of the physical property as are labor and supplies. These estimated overheads are a part of estimated appraisals but, as such, are no part of a valuation. The value of such expenses as have been made in any construction constitutes a part of the value of the whole physical property, but it requires little thinking to know that such estimated 'overheads' in any supposed construction, at the time, are not taken as the value of such expenditures as were made for 'overheads' in the construction of any plant heretofore constructed and on which a value is being found. Such estimated appraisals and the various parts thereof are not accepted as true values, but are received for whatever they may be worth as an aid during the necessary judicial determination when finding a value, and nothing more. It is elementary that they are not taken as nor added to values when once fixed, but there can be no question that, under the law at this time, they must be considered in arriving at a value."

Recent Court Decisions

Alaska Municipality Held Without Power to Fix Electric Lighting Rates for Definite Term.—The United States Circuit Court of Appeals has found in adjudicating a suit brought by the Alaska Electric Light & Power Company against the city of Juneau that an act of 1904 giving municipal corporations in Alaska authority to provide for fire protection, water supply and lighting carried with it power to grant a franchise to an electric company, but did not confer power on a municipality to enter into a binding contract fixing rates which should remain in effect during the life of the franchise. The right of a municipality to fix rates for a public service by contract, to remain unchanged for a definite term, the court said, can rest only on power unmistakably delegated to it by legislative authority. (294 Fed. 864.)*

Negligence May Be Adduced as Conclusion Where Facts Alleged Show Duty.—In Mauney vs. Electric Construction Company et al. damages were sought because of the destruction of plaintiff's house through alleged faulty electrical wiring by the defendants. The trial court found for the company, and the Supreme Court of Alabama has sustained this finding, throwing out a bill of exceptions because alleged clerical errors were corrected after the bill had been signed by the trial judge. The Supreme Court ruled, however, that where the facts averred show that the defendant was under a duty to the plaintiff it may be announced by way of a conclusion that the defendant's negligence proximately caused the damage. The court said: "The complaint avers facts that showed defendants' duty in the premises: (1) That for a reward paid them they undertook to equip the plaintiff's house properly with wires and other devices; (2) that through such instrumentality the house was to be lighted by electricity; (3) that defendants did this work by and through their servants and agents in such manner that they (4) negligently failed to insulate said wires properly, so that, coming in contact with the woodwork of the house, by reason thereof it was set fire to and burned, to the proximate damage sought to be recovered by this suit. This was a sufficient averment of duty and negligence in its discharge and of the proximate damage resulting from the failure of said duty to plaintiff." (98 So. 874.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Utility Has Right to Amortize Losses Sustained Under Rates Fixed by Commission.—In Louisiana Water Company vs. Public Service Commission of Missouri, the United States District Court for the West District of Missouri found that a public service corporation is entitled to earn a fair return on the reasonable value of its property at the time it is being used for the public, and that a rate fixed by a public service commission, under power delegated to it by the Legislature, which does not furnish such fair return is confiscatory in effect and in violation of the Constitution of the United States. A company which, under rates fixed by a public service commission, has sustained a continuous loss during a period of years is entitled to amortize such loss, and future rates fixed by the commission should be so adjusted as to permit such amortization. (294 Fed. 954.)

Value of Utility Property Rises and Falls with the Dollar.—In a suit brought by the city of Little Rock against the Arkansas Water Company in the United States District Court for the Eastern Division of Arkansas the special master appointed to consider testimony ruled out the theory of actual investment as applied to fixing the value of public utilities. The value of such property, he asserted, must rise or fall as the purchasing power of the dollar rises or falls, and the value of a utility plant for rate-making purposes is the present reproduction cost new less a proper amount for accrued depreciation. It was said, the special master observed, that the value of a private enterprise is fixed by its earning power and that there are companies which have a market value much above the par value of their stock because their incomes pay the usual rate of return upon such market value. This, according to the decision, is not true with reference to public utilities whose rates are subject to regulation by the state. Their incomes are limited, the rate which public utilities are permitted to charge determines the market value of their stock, and for that reason in determining the value for rate-making purposes there can be no market value. In the opinion of the special master, the investor in utility property was entitled to a rate for service for the use of his property by the public in 1923 which would give him an income the purchasing power of which would be equal to the purchasing power of his income of 1913, provided, of course, there had been no waste or wear of his property. The subject was treated from the standpoint of the stockholder or owner and not from the standpoint of the man who loans money to the utility, by buying either preferred stock or bonds, since he takes no risk and secures stability and certainty of income rather than profit from increased values or loss from decreased values.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Value of Graphic Indexing

A Method of Catalog Indexing that Follows the Plan of an Organization Chart and Is Adaptable to Many Lines

By C. H. Ribble
District Manager Industrial Controller Company, New York

GIVEN a skilled workman, foreman, superintendent, purchasing agent or other presumably intelligent and resourceful person and an average technical or trade catalog: To find the length of time and time cost of hunting down in that catalog some particular article and necessary information concerning it. This is an every-day problem.

No matter how expert or well informed one may be in his own line, he cannot know all the technical terms or trade expressions of other lines occasionally coinciding with his. The cold type of a technical index is neither a universal language nor a quickly understandable guide to his objective. Moreover, pictorial illustration—the only universally understood "language"—is of little or no help to quick location, since no line can be pictorially compressed into an "index." So the non-technical office force continues to wander in the labyrinth of the index, and the trained executive wastes much valuable time of his own, and perhaps his customers' or subordinates', until exhaustive search finally produces the object sought.

Knowing that our own catalog shared this weakness, it was decided to work out some plan whereby those interested in control might obtain an easy, natural and quick method of discovering just which type of equipment best serves their purpose and all necessary information regarding it. Having in mind the modern tendency to depend upon visualization for rapid investigation and understanding human impatience with time or labor expenditure in such cases and the immense saving to be effected through an index understandable by the non-technical person, the problem became one of making it possible for any member of another organization to give to or receive from any member of our organization prompt, reasonable and reliable primary information during the absence of technical executives.

In the control line the problem proved not so hard as it first seemed. Motor control being dependent upon certain basic conditions and applications, it was found possible to graph conditions, applications and equipment by the same methods used in the preparation of organization charts. Given the basic conditions and our "graphindex" (illustrated in Fig. 1), either mechanic, engineer, purchasing agent or clerk has visualized before him the various applications and need only "follow the line" to locate the exact equipment suitable for the particular work in question.

As an example: An electrician has a job for alternating current of given voltage, phase and frequency, requiring automatic push-button starting of a 5-hp. squirrel-cage motor. Naturally he wishes to know just what starting equipment is best for the job, and he refers to the "graphindex" of the industrial controller catalog, finds the alternating-

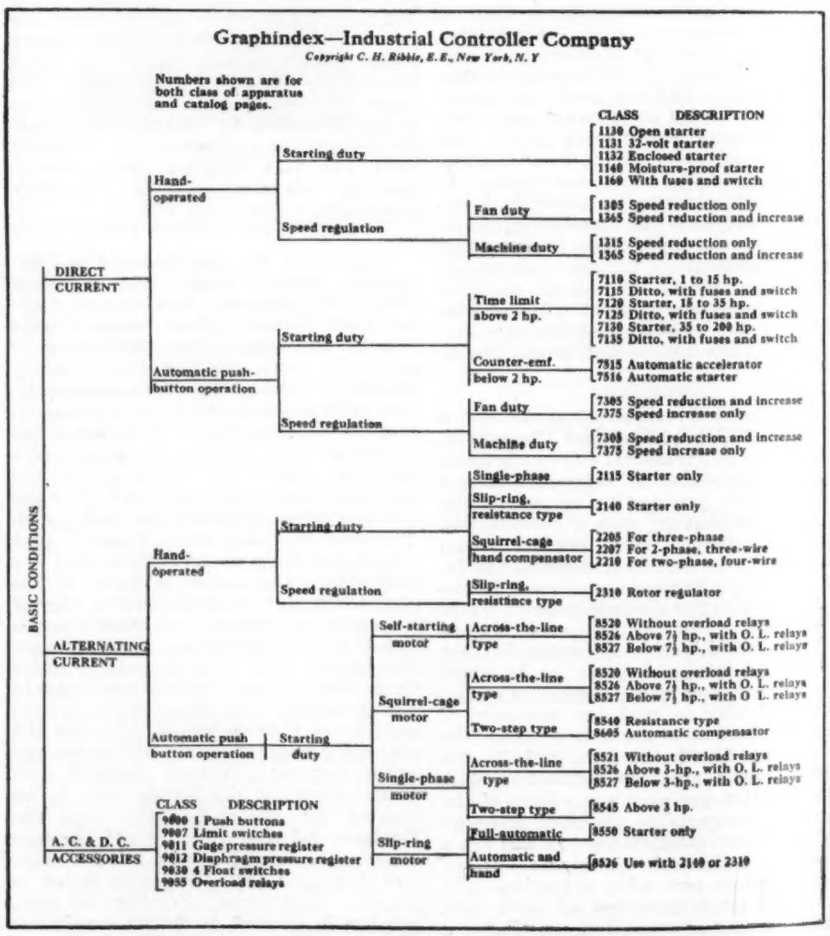


FIG. 1—THE "GRAPHINDEX" PLAN OF INDEXING MOTOR CONTROL TO SIMPLIFY THE USE OF CATALOGS

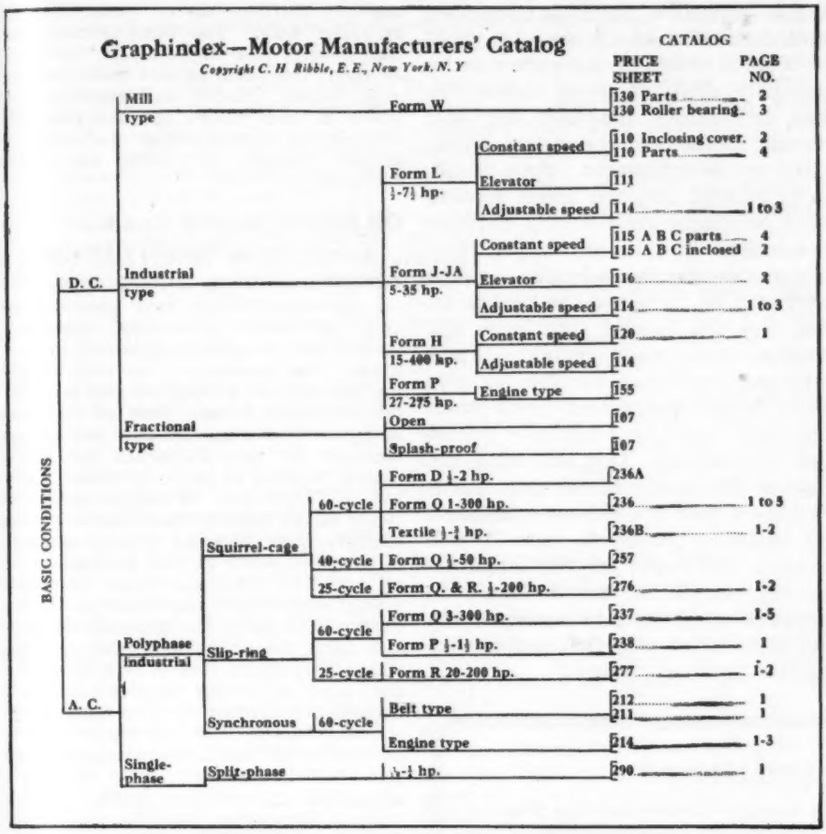


FIG. 2—THE "GRAPHINDEX" AS APPLIED TO A MOTOR MANUFACTURER'S LINE

current division, follows the lines through "automatic push-button operation," "starting duty" and "squirrel-cage motor" until he finds two types available, discovering that because of the motor horsepower and the additional overload protection the Class 8527 "across-the-line" starter is just the thing he wants. The class number being also the page number of this catalog, he derives all desired technical information immediately and need only ask "How much?" and "When?"

In practical work-out this "graphindex" has proved most successful. A new and entirely inexperienced office boy soon began to quote correctly over the telephone without having to refer inquirers to his chief. Motor salesmen began to sell control with their motors because now they could "see" and understand just what they should have or offer. Consumers were enabled to approximate their needs with considerable accuracy. All this effects a great saving in time and trouble as compared with the old indexing methods.

That graphic indexing is adaptable to many lines is apparent upon a little thought. The application illustrated in Fig. 2—that of a motor manufacturer's line—is indicative of the simplicity and usability of this plan for any technical or non-technical person desiring to "get down to facts" in lines otherwise seemingly almost mysterious.

Permanent Status for Foreign Trade Service

THE committee on interstate and foreign commerce of the House of Representatives is disposed to press for an early vote the bill which gives a permanent legislative status to the foreign service of the Department of Commerce. Unexpected opposition arose to the measure from other departments of the government based on the fear that the Department of Commerce might encroach upon some of the prerogatives of the foreign service of other departments.

The feeling prevalent among the members of the House committee, however, is that the better service which this will give American business and American interests generally far outweighs the trepidation of other departments as to a possible technical invasion of their respective jurisdictions abroad. Apparently the bill does not meet with the approval of the American Protective Tariff League, as it has given publicity to adverse comment on the measure and a statement to the effect that Secretary Hoover and Director Klein of the Bureau of Foreign and Domestic Commerce are "entirely out of sympathy with the Republican doctrine of adequate protection of American industries." The House committee, however, has amended the bill in a way which it believes will prevent any conflict between the foreign service departments of the government.

Secretary Hoover regards it as almost inconceivable that an establishment on which the government is expending a million dollars a year should continue to be constantly menaced by the whim of any one who may be in a position to make a point of order against the appropriation. The million dollars is being expended, he points out, in the interest of the promotion of American trade and in obtaining vital commercial and economic intelligence, for the great readjustments in world commerce which have followed the war necessitate much more deliberate strategy in our commerce.

Is This Good Salesmanship or Unfair Competition?

SEVERAL electrical manufacturers have called attention to the fact that certain makers in the industry are following a sales policy which seems destined to prove exceedingly destructive to free creative competition and the adequate service of the market. Apparently they have carefully estimated the total amount of electrical equipment which different users are buying annually in each line of manufacture, and are inducing many of these users to sign contracts to buy all of their equipment from the one source, offering a considerable discount on all equipment purchased under such contracts.

To make the contracts specific, it is said that manufacturers who are following this practice are stipulating in the contract that so many dollars' worth of motors, control apparatus, etc. (based on the previous year's total purchases), shall be purchased from the one manufacturer and from no other. According to the manufacturers who complain of this alleged practice, many users, naturally anxious to obtain the lowest prices obtainable, sign these con-

tracts without realizing that in effect their observance will prevent the exercise of the purchaser's free will and judgment. Furthermore, some of the manufacturers pursuing this practice are furnishing control equipment with the motors purchased under such contracts at a price which is equal to or less than the price at which the manufacturers who complain can themselves make the control apparatus.

The manufacturers who criticise this practice maintain that they cannot meet this form of competition by adopting like methods because they lack the widespread sales representation possessed by these competitors. Furthermore, they maintain that, according to a court decision rendered in one state of the Union, such contracts are not supportable in law. To meet this form of competition it is necessary to give the same or greater discounts than those offered under the exclusive contracts, making it impossible for such competing manufacturers to derive any profit on a small order, or more than an inadequate profit on large orders, unless the orders approach the total annual demands of the customer purchasing the equipment. As a result, it is pointed out, the users signing such contracts are not only limiting themselves in the exercise of their natural desire for selection (unless they choose to break the contract), but they are forcing such large discounts that many manufacturers who may at times be able to give them better equipment for certain purposes, may be eventually forced out of business. This will leave the user at the mercy of the few manufacturers who are selling equipment on exclusive contracts, and it will weaken the power of the manufacturing branch of the industry to produce equipment, to assist in the development of a market and to give service to the consumer.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ALTHOUGH there has been no marked increase in the business of the electrical industry this week, a general improvement is noted throughout virtually the whole country. The number of inquiries that manufacturers are now receiving give a very promising outlook for the month of April. In certain territories negotiations are now under way involving business larger than at any time during several years past, and jobbers report that sales are now quite equal to those of January, although in one or two instances reports are not so encouraging. This condition seems to be due to operating on a closer margin, when, of course, gross profits are less. The volume of business, however, even in these cases is found to be better than it has been for some time. Buying is still conservative, a condition that is reacting to the better interest of the industry. The very few minor price fluctuations that have taken place within the last few months form an excellent indication of present stability.

In the New England district increased activity in the building industry has created a good demand for building construction material, and a good deal of industrial plant improvement is in progress with a consequently large movement in miscellaneous electrical supplies. A general improvement is still evident in the New York district, where small apparatus is enjoying good sales, and there is every prospect for increased sales during this month. In the Southeast district business continues steady and in good volume. Sales of large motors are much below those of a year ago, but the outlook for increased demand is encouraging. In the Middle West there has been a noticeable revival of buying for the spring trade and building activities are growing. The Pacific Coast also reports a building increase, and there is prospect of a large irrigation project getting under way. Retail and industrial buying appear rather quiet because of the dry weather, which has affected crop prospects.

Knife-Switch Makers Confident of Good Year's Business

MANUFACTURERS of knife switches report a healthy demand for these products, and as the building season gets under way a good volume of new orders is anticipated. A representative house which turns out a large quantity of switches for interior wiring service said last week that sales are running about 25 per cent in both quantities and money above a year ago. There is a good demand at present for heavy-duty, high-current switches required by the larger utility companies and important power-using industries. Many of these are built to original specifications, and for this reason there is not as much production for factory stock as in the field of disconnecting knife switches.

At this season a good deal of plant designing is on the boards of engineers for construction later in the year, and some accumulation of standard designs of "disconnecting" switches for immediate delivery out of factory stocks is under way. The total demand for heavy-duty and high-voltage switches is about the same as last year and the year before. Labor and material are plentiful and prices are sluggish, although one manufacturer complains of a low margin of profit on house switches.

Oil-Engine Market Good—Tendency to Simplify Design

THE demand for oil engines is better than it has ever been before and, according to several manufacturers, this demand is expected to continue. The increase is not only affecting the number of engines sold but also tends toward larger sizes of engines. A number of inquiries are now being received by manufacturers for large plants ranging in capacity from 10,000 kw. to 25,000 kw. Within a comparatively short time former steam engine builders have diverted a large amount of shop capacity to the production of oil engines. This has acted to create highly competitive conditions in the industry, and while the growing demand is helping the situation to some extent, it has also stimulated efforts to reduce the cost of oil-engine manufacture, with a resulting downward price trend.

Reduction in costs has been attained primarily by an ever-increasing simplicity in design, principally by standardization of sizes and parts, coupled with an increasing quantity production, further helped out by a decrease in the number of types offered. For instance, it has now become common shop practice to build three, four, six and eight-cylinder engines of the same cylinder diameter, which favors low shop production cost and reduces stock inventory. To-day the prices of improved designs of oil engines vary from $70 to $85 per horsepower.

Deliveries are at present good, varying from thirty days upward according to the size of the engines, but whenever a manufacturer obtains a large volume of business the limiting features usually are the forgings and the facilities at his command for production purposes. It is interesting to note that conservative oil-engine manufacturers are now refusing to offer oil engines in places where they will not prove ultimately economical to the purchaser.

Electric Furnace Demand Gaining —Tendency Toward Standardization

GRATIFYING gains in both inquiries and sales of electric furnaces for industrial service are reported by manufacturers. There was an upward trend in the sales of furnaces during 1923, and from present indications this trend should continue through 1924. The good sales records and the excellent outlook for electric furnaces are largely due to a number of successful installations of various sizes of equipment, resulting in economies and improved quality of work. In addition, the continued application of electric furnaces for various other industrial purposes is very encouraging, for new fields are constantly being opened up.

The infancy of this branch of electrical development, of course, makes comparisons of percentage gains in sales this year as against the same period last year less significant than similar figures would be in older and more popular lines.

There is a tendency toward standardization in design, construction and size of furnaces wherever possible, and where this can be done a reduction in the price of the furnace can be realized. However, this applies almost entirely to the smaller sizes used for general heat-treating work. There is also a tendency toward securing automatic features to assist in increasing production.

The larger furnaces for commercial production in considerable scale are of necessity special in nearly every instance, and accordingly prices of the larger furnaces can be reduced only to the extent permitted by the standardization of component parts and by the increased volume of business, which tends to reduce fixed charges. Although there has been a slight increase in the cost of electrical equipment, manufacturing costs have changed little and prices are at present firm.

Deliveries in some cases are said to be lengthening a little owing to the problem of getting refractories and transformer equipment into the manufacturers' hands in time to meet immediate needs. On standard sizes of moderate capacity deliveries vary from stock to five weeks, while on the larger production furnaces, which have to be designed for each job, delivery will always depend upon the amount of special materials required and the length of time necessary to secure them.

Chinese Electrical Market Inactive

PURCHASES of electrical equipment by Chinese mills, railways and lighting plants are not extensive owing to the present unsettled conditions there, according to Trade Commissioner G. C. Howard of Shanghai. Some re-equipment business is expected to be placed, but until capital can be safely invested and general business conditions improve to a point where present industries are in a position to pay dividends the outlook for new business in electrical apparatus lines will not be encouraging. British, Swiss and German competition in electrical equipment continues to be very keen.

Building Industry Buying Electrical Material in New England

INCREASING activity in the building industry in New England, combined with widespread expansion of central-station facilities and the success of a number of electric "homes" and shows in arousing popular interest in appliances, is working effectively to hold the volume of trade to very respectable totals, notwithstanding recessions in some lines of general business.

Poles and pole line hardware are moving vigorously in the central-station field; wire is active for outdoor work, and cross-arms are in excellent demand. A good deal of industrial plant betterment is in progress, thus creating a demand for miscellaneous electrical supplies in substantial volume, but motors are moving sluggishly.

Close competition for motor business is believed to be the cause of a recent 5 per cent price reduction by two prominent makers of alternating-current equipment. Other prices show little movement, although within a few days a mid-New England central-station company marked down several more common sizes of incandescent lamps to 20 cents net. In this district as a whole lamp sales are running slightly ahead of last year. Jobbers are preparing to handle a good trade in radiant heaters during the next few weeks and kitchen-lighting equipment and electrical accessories for automobiles are moving well. Storage batteries for generating and substation work are more active than usual. Deliveries are causing little complaint, barring some delay in radio "B" storage-battery movement.

Improvement in New York District Still Evident

THE general betterment in business which was reported last week still continues. The number of inquiries being received at present is a very healthy indication of an upward trend during this month. Small apparatus and small motors continue in very good demand. Stocks on this class of apparatus are now in good shape with consequent prompt deliveries. Deliveries on turbines up to about 5,000 kw. are reported as being in good shape, while deliveries on power transformers are still rather long owing to the heavy buying.

In the jobbing industry business has improved again, reaching the volume established in January, which is considered encouraging, although profits are more difficult to make. Construction material is moving best there is a steady business in small appliances and wire and conduit are in good demand, but most of the large orders in this material are sold direct by the manufacturers. A still further improvement in business is expected with spring buying. Stocks are good and collections are in fairly good shape.

Business Continues Steady in Southeast District

THERE have been no high lights in electrical circles in the Southeast district during the past week. Most jobbers report that business is fine, and one jobber says that sales on all items are even better than last year. With the exception of radio materials, jobbers' stocks are in fine shape, though dealers' stocks are only fair to good as a result of conservative buying. Poles and pole-line hardware continue in brisk demand, one jobber reporting the receipt of orders for five carloads of poles last week and one order for ten carloads practically closed. The only price changes are ½ cent per pound reductions on bare copper and weatherproof wire announced by one of the largest jobbers.

The slowing up in industrial activities is reflected in the orders for electric motors in the large sizes, sales being considerably below those of a year ago. However, there is an increasing number of inquiries being received by manufacturers for this class of equipment. The sales of the smaller size motors are satisfactory. Oil switches are moving well, with the 60-amp. to 200-amp. in greatest demand.

Good Demand for Wiring Material in St. Louis

BECAUSE of much building activity in St. Louis there has been a splendid demand for wiring material and fixtures as well as for poles and pole-line hardware for public utility construction. The demand for household electrical appliances has been excellent. Jobbers report that the advance orders for fans have been even better than they anticipated, but that the demand for radio has fallen off a little. There has also been a fair demand for motors for industrial purposes and for transformers of the larger sizes.

In general, business was good during the month of March. Stocks are increasing to take care of the spring trade. Collections are improving and prices are steady, except on those articles that have been affected by the recent changes in the price of copper.

Electrical Buying Revives in Middle West

ELECTRICAL business revived somewhat in the Chicago territory this week. Central-station purchases, while mainly for secondary equipment, were normally good with watt-hour-meter purchases as the main outstanding feature. One order for mercury-arc rectifiers of considerable proportions and contracts for extensive underground extension of power lines were placed this week. Pole-line hardware demand remains good. The contemplated extension of power lines just outside the vicinity of Chicago should increase the demand for this class of material substantially. Radio sales continue active, and the electrical trade feels optimistic, with the expectations of a profitable summer.

Very favorable weather conditions have permitted a resumption of building activities, wiring devices and wire being purchased in greater quantities by contractors. Spring construction has started and the principal item of note in Chicago is the starting of a forty-million-dollar hotel in the business district. The number of building permits taken out during March was 1,651, valued at $26,712,900, as against 897 in February, valued at $18,694,400.

Building Active on Pacific Coast —Retail Business Quiet

BUILDING on the Pacific Coast is moving briskly with March, 1924, as a whole showing very good increases over 1923. Many large buildings are now in progress in San Francisco, each containing considerably over $50,000 of electrical work, the material for which will soon be purchased. Important orders placed during the week for electrical material included $10,000 worth of high-tension insulators for an

irrigation project and a fifteen-thousand-dollar pole-line hardware order for a water and power project. There is also an inquiry for material for an Arizona irrigation project which is estimated to cost $75,000.

There has been a reduction in the price of copper wires of ½ cent per pound. No other price changes are reported. Industrial ordering is rather quiet. This exceeding dullness is attributed to the influence of the dry weather on such sections as the San Joaquin Valley and Southern California, which as usual are sources of heavy buying, but where crop prospects are not good just now and the outlook is not very encouraging.

The Metal Market

THIS week has been quiet in the non-ferrous metal market. Prices have been trending downward in most metals and buying has been only for immediate needs. The Dawes report on reparations is creating quite an interest, for European conditions have been a governing factor in the metal market for some time. The weakness in the copper market early in the week is hard to diagnose as the statistics for March are most encouraging. While copper production has not been cut much, shipments have reached very large proportions, exceeding all past records.

NEW YORK METAL MARKET PRICES

	April 2, 1924 Cents per Pound	April 9, 1924 Cents per Pound
Copper, electrolytic	13½–13¾	13¾
Lead, Am. S. & R. price	9.00	8½
Antimony	10½–11	10½
Nickel, ingot	26	27
Zinc, spot	6½	6.55
Tin, straits	51½	50¾
Aluminum, 98 to 99 per cent	28–29	27–28

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Acme Wire Company Reports Good Year

The Acme Wire Company, New Haven, Conn., in a report for the year ended December 31, 1923, shows total current assets and inventories of $1,121,206 with current liabilities of $418,116. There are outstanding 4,485 shares of 8 per cent cumulative preferred stock with a par value of $100 each and 39,903 shares of common stock with a par value of $25 each.

Dividends of 8 per cent were paid on both the preferred and common stock during the year. The company has no bonds, funded debt or contingent liabilities. During the year net quick assets increased over $100,000.

Western Electric Holds Pacific Coast Conference

The annual Pacific Coast sales conference of the Western Electric Company, held in March at the Hotel Del Monte, California, was presided over by E. J. Wallis, Pacific district manager, and attended by the following sales executives from the Western branch houses: Messrs. Berry, Brown, Calloway, Colwell, Goldrick, Harper, Nicoll, Vandercook and Ward.

Court Sustains General Electric Patents on Lamps

The United States Circuit Court of Appeal on April 7 affirmed a decision of the District Court sustaining the claim of the General Electric Company to the ownership and the validity of the Just and Hanaman patent on the tungsten lamp and the patent on the gas-filled lamp, the invention of Langmuir. The defendants were P. R. Mallory & Company, Inc., and the Save Electric Corporation.

In a statement regarding the decision the General Electric Company said that it has been able through the utilization of the invention of Just and Hanaman to reduce the cost of a given amount of electric light to about one-third the cost with the standard carbon lamp. Under the Langmuir patent this cost in the case of the larger sizes of lamps was still further reduced to about one-sixth.

Allis-Chalmers Orders Decline

During the month of March incoming orders to the Allis-Chalmers Manufacturing Company fell off approximately 20 per cent as compared with previous months. This decrease was mainly due to the fact that no orders of unusual size were received during the month. However, although there was a falling off in orders, production is not being curtailed and the company is operating at about the same rate as in the latter part of 1923, there being a number of unfilled orders still on the books. At present a number of large contracts are under consideration and bookings are expected to increase during this month.

Stewart Electrical Manufacturing Buys Safety Electric

The Stewart Electrical Manufacturing Company, San Francisco, Cal., has purchased the stock and business of the Safety Electric Company, that city, and will in the future be at the latter's plant, 59 Columbia Square, San Francisco. The company will continue to manufacture switches, switchboards and other similar lines. J. T. Stewart and E. W. Lange are the proprietors of the Stewart Electrical Manufacturing Company. They have retained in their employ L. J. Van Atta and the sales and engineering forces of the Safety company.

International General Electric Income Increases

The report of the International General Electric Company for the year ended December 31, 1923, shows a net income, after expenses, interest and taxes have been deducted, of $2,469,463, as compared with $2,265,477 for the previous year. Unfavorable conditions in foreign countries affected the sale of electrical apparatus manufactured for the company. Yet, notwithstanding these conditions, orders were booked during 1923 amounting to $21,743,000, as compared with $21,536,000 during the previous year. More intense competition from British and Continental manufacturers, as well as increased manufacturing costs, resulted in a reduction of profit from selling operations from $1,403,313 to $967,506 for 1923.

Assets are thus shown: Patents, furniture, fixtures, etc., $1; investments, $18,998,364; notes receivable, $2,664,784; merchandise, $2,291,097; accounts and notes receivable, $8,033,471; cash $1,354,223; and deferred charges, $832; making a total of $33,342,772. Liabilities include: Preferred stock, $10,000,000; common stock, $10,000,000; surplus, including premium on capital stock, $8,168,220; general reserves, $1,000,000; accounts and notes payable, $1,705,308; and advance collections and accruals $2,469,244.

Worcester Jobber Holds Customers' Meeting

Customers and friends of the Coghlin Electric Company, Worcester, Mass., were entertained at the headquarters of that organization on April 4, nearly all the New England states being represented among the guests. The program included an inspection of the company's warehousing facilities and offices, a visit to the Worcester "house electrical," recently opened to the public, and in the evening a dinner at the State Mutual Restaurant, followed by an exhibition of a Westinghouse film featuring lamp manufacturing. C. A. Felker, manager of the company's jobbing department, was toastmaster, and addresses were made by J. P. Coghlin, president, and J. W. Coghlin, assistant treasurer, of the Coghlin organization, and C. A. Norton, newly appointed manager of the New England Westinghouse Lamp Works.

The Carlisle & Doughty Company, 2530 Broad Street, Philadelphia, manufacturer of electric storage-battery equipment, etc., has tentative plans for the rebuilding of the portion of its plant destroyed by fire March 28, with loss of about $45,000, including equipment.

The Deal Electric Company, Inc., 453 Broome Street, New York, manufacturer of electrical apparatus, has leased space in the building at 47-49 Greene Street for extensions.

The Mica Insulator Company, New York, has recently elected the following officers: L. W. Kingsley, chairman of the board; Edward T. Wood, president, and Edward Nelson, secretary and treasurer. All of these men have been identified with the Mica Insulator Company for a very long time.

The Zeller Lacquer Manufacturing Company, New York, announces the establishment of two new branch offices with stockrooms at 603 East Seventh Street, Los Angeles, in charge of C. H. Gaylord, and at 67 Steuart Street, San Francisco, in charge of W. W. Partridge. The Ormor Sales & Supply Company, 1428 Court Place, Denver, has been appointed distributor in that city, where a stockroom is also maintained.

The Reynolds Electric Company, Chicago, has appointed the W. F. Irish Company, 120 West Thirty-second Street, New York, distributor for "Reco" flashers, color hoods and flasher repair parts as well as flasher motors in the New York territory. A complete stock is carried on hand at all times.

Pass & Seymour, Inc., Syracuse, N. Y., will move their export department on April 15 from 66 West Broadway to 71 Murray Street, New York.

W. N. Matthews & Brothers, Inc., St. Louis, have leased the building formerly occupied by the Davis Boring Tool Company at Forest Park Boulevard and Spring Avenue and on April 5 moved from their former quarters at 2922 Easton Avenue. This new building gives the Matthews company a better location and provides more floor space for both offices and factory.

Jones-Beach & Company, 50 North Seventh Street, Philadelphia, manufacturers of electrical supplies, have purchased property, including land and building, at 619-29 Wood Street and 312 North Marshall Street, for a consideration said to be $130,000, and plan to remodel and equip for a new plant.

Hatzel & Buehler, Inc., electrical engineers and contractors, 373 Fourth Avenue, New York, announce the election of R. A. Goeller as second vice-president in charge of construction. Mr. Goeller has been with the company since its incorporation in the capacity of general superintendent.

The Combustion Engineering Corporation and the Green Engineering Company opened an Indianapolis office on March 15 at 315 Guaranty Building. It will be under the direction of B. J. Schneider.

The Haughton Elevator & Machine Company, Toledo, Ohio, announces the opening of the following branch offices: Atlanta, 209 Bona Allen Building in charge of H. C. Seipp, Jr.; Washington, 907 Fifteenth Street N. W., in charge of S. P. Blakeman; Buffalo, 405 Lincoln Building, in charge of G. L. Morgan. These offices will provide better facilities for service in their respective territories.

The Causbey Engineering Company, Inc., announces its removal from 1011 Chestnut Street to the Bankers' Trust Building, Philadelphia. The organization has been recently incorporated and has also increased its staff to eight graduate engineers.

The Roseland Storage Battery Company, 11,402 South Michigan Avenue, Chicago, has tentative plans under consideration for the erection of a two-story and basement plant for storage-battery and equipment manufacture at Michigan Boulevard and 115th Street, estimated to cost $50,000.

The Westinghouse Electric & Manufacturing Company has replaced its girl-operated winding machines with a number of automatic machines for winding magnet coils. The new machine is manufactured by the Universal Winding Company, Boston, and is capable of winding coils from ¾ in. to 6 in. in diameter and with a maximum length of 3¼ in.

The Ruggles-Klingemann Manufacturing Company, 200 Devonshire Street, Boston, was recently appointed exclusive New England representative of the Uehling Instrument Company, Paterson, N. J., manufacturer of CO_2 recorders and indicators and other power-plant instruments.

W. D. Crumpton & Company, 8 Bridge Street, New York, announce that they have taken over the complete distribution and sales of Thornton electric brazing machines, manufactured by Thornton Electric Brazers, Inc. These machines are adapted to brazing all sizes of wires from the smallest to 1 in. in diameter as well as for various other uses.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

New Lock-Type Disconnecting Switch

A new patented disconnecting switch of the high-voltage type is now being placed on the market by Thoner & Martens, 463 Commercial Street, Boston. Standard designs range from 2,500 volts upward in capacities of 500 amp. and above. The blading forming the switch pole carries a composition casting at the top or side. A finger lever, bolt and spring-controlled catch are provided to enable the blading to lock into position on closing and to remain so until released by a switch stick. Increased mechanical strength in design is secured as compared with the lower-voltage types of locking "disconnects" made by this company.

"Speedway" Drill—A Correction

In the March 22 issue of the ELECTRICAL WORLD, on page 603, a portable electric drill known as the "Speedway" was listed as having been recently placed on the market by the General Electric Company. This was an error, as only the motor is manufactured by the General Electric Company, the drill being a product of the Electromagnetic Tool Company, Chicago.

Instrument for Recording Voltage Surges

A new instrument for recording abnormal voltages on transmission lines, known as the "klydonograph," has been developed by the Westinghouse Electric & Manufacturing Company. With this instrument a graphic record of voltage surges of extremely short duration can be obtained, giving their polarity, magnitude, steepness of application, etc.

A photographic plate is used to obtain the record, the voltage being impressed between a terminal and a ground plate. The instrument is made continuously operative, being driven by a clock, and is capable of recording the exact time of the occurrence of the disturbance. The instrument can be connected electrostatically to the line, thus avoiding any insulation hazard. By using two instruments, one connected to the line and the other to a counterpoise, complete information concerning the surge can be obtained. The counterpoise is run underneath or alongside the transmission line for 1,000 ft. or 2,000 ft. with the far end grounded directly and the near end grounded through a high impedance. The instrument is connected across this high impedance to ground.

Thermal Relay

A new thermal overload relay, designed to follow more closely the heating curve of the motor, has been developed by the General Electric Company. The relay contains two heating elements—a thermostatic strip corresponding to the copper in the motor, and another element, corresponding to the iron in the motor, inclosed in a metal block which, when heated, tends to increase the temperature of the thermostatic strip by conduction and radiation. This arrangement inherently takes into account the previous heating of the motor due to the heat stored in the metal block being a measure of the heat stored in the motor. The relay is made in both single-pole and double-pole types.

Fractional Horsepower Starter.—A fractional-horsepower starter for direct-current motors—115 volts or 220 volts—with low voltage protection, is being placed on the market by the Ward Leonard Electric Company, Mount Vernon, N. Y. The starting resistance of the unit limits the inrush of current and prevents overloading the motor when starting. The porcelain base of the starter is designed to be installed in a 4½-in. standard outlet box.

Service Switch.—A service and industrial switch has been developed by the Palmer Electric & Manufacturing Company, Cambridge, Mass., and is available in sizes from 30 amp. to 200 amp. The switch is so designed that when it is open the fuses are entirely disconnected from both line and load terminals. It is of the fully inclosed safety type and is provided with quick make and break. The main cabinet cover is normally secured by a lock or seal which may be removed for switch inspection with the switch in the "on" or "off" position. The fuses are protected by a cover which is accessible if the switch is open but must be shut and locked before the switch can be closed.

New Trade Literature

LINE MATERIAL.—The Line Material Company, South Milwaukee, Wis., has issued a "Line Material Bargain List" which contains a list of equipment which it has discontinued manufacturing and which it will dispose of at reduced prices.

CONTACTOR.—The Monitor Controller Company, Baltimore, has issued a folder describing the "Monitor" contactor.

PRECISION INSTRUMENTS.—R. W. Cramer & Company, Inc., 136 Liberty Street, New York City, is distributing a folder calling attention to the line of precision instruments, made in Switzerland, carried by the company.

VENTILATING FANS.—The American Blower Company, Detroit, is distributing two folders, one calling attention to the American Blower ventilating fans and the other to its portable home ventilating fan.

FANS.—The Century Electric Company, 1,827 Pine Street, St. Louis, has issued catalog No. 36, covering its alternating-current and direct-current portable and ceiling fans.

ELECTRIC CONTROL.—The Sundh Electric Company, Inc., 5 Avenue C, Newark, N. J., is distributing pamphlet No. 88, which describes and illustrates various types of the "Sundh" electric control for fire pumps. It also contains regulations of the National Board of Fire Underwriters. The company has also issued a pamphlet describing the "Sundh" automatic control for mechanical refrigeration plants.

PUMPS.—William E. Quimby, Inc., 209 Parkhurst Street, Newark, N. J., has issued two pamphlets, one covering the "Quimby" vertical sump pumps, sewage ejectors, solid and split case centrifugal pumps, and the other the "Quimby" screw pumps for handling water, oils and semi-liquids, capacities from 1 gal. to 4,200 gal. per minute.

BATTERY CHARGERS.—The Hobart Brothers Company, Troy, Ohio, is distributing a folder covering the "HB" 400-500-amp. constant potential charger, designed for the larger battery service stations.

ICE MAKING AND REFRIGERATING MACHINE.—Bulletin No. 69 issued by the York Manufacturing Company, York, Pa., contains a description of the "York" type Y-16 vertical single-acting inclosed ice-making and refrigerating machine.

TEMPERATURE CONTROLLERS.—The Foxboro Company, Inc., Foxboro, Mass., is distributing a folder calling attention to various types of the "Foxboro" temperature controllers.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in Turin, Italy (No. 9,722), for electric self-starter equipment for automobiles.

Purchase and agency is desired in Nagoya, Japan (No. 9,729), for electrical heating apparatus and other appliances, such as boilers, ovens, cooking apparatus and vacuum cleaners.

An agency is desired in Bombay, India (No. 9,725), for electric lamps, table and ceiling fans, fittings, etc.

An agency is desired in Winnipeg, Canada (No. 9,717), for radio sets.

An agency is desired in Lisbon, Portugal (No. 9,728), for radio sets, apparatus and batteries.

An agency is desired in Belfast, Ireland (No. 9,727), for radio sets, especially crystal, and supplies for amateurs.

Purchase is desired in Bluefields, Nicaragua (No. 9,747), of electrically driven ice-cream freezers and manufacturing equipment.

Purchase is desired in Montevideo Uruguay (No. 9,779), of electric winch and capstans for shipyards.

An agency is desired in Geneva, Switzerland (No. 9,759), for gas and electric heating apparatus.

INCREASE IN THE USE OF WATER POWER IN CZECHOSLOVAKIA.—In its efforts to conserve coal and to reduce the costs of manufacturing, the government of Czechoslovakia, according to *Commerce Reports*, is endeavoring in every possible way to increase the use of its water-power resources throughout the republic. In furtherance of this purpose a dam is being built across the Valley of Cerna Desna in Northern Moravia, at a cost of about 7,500,000 crowns, of which 40 per cent will be supplied by the government. Other water-power developments are being planned by the government to be carried out during 1924.

New Incorporations

THE BEAR VALLEY ELECTRIC COMPANY, Richland Center, Wis., has been incorporated with a capital stock of $25,000 by Jerry Schlough, Lone Rock, and A. G. Barber, Richland Center. The company proposes to construct a hydro-electric plant on Bear Creek between Gotham and Lone Rock.

THE MOUNT EDEN (KY.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $3,000 by J. P. Kirkland, John H. Green and A. M. Cock.

THE SHAWSVILLE (VA.) LIGHT & POWER COMPANY has been organized to construct and operate an electric system. G. W. Gardner is president and J. R. Sisson is secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME. — The Cumberland County Power & Light Company contemplates a 12,500-kw. extension to its steam plant at South Portland and the erection of a 11,000-volt substation at Knightsville, and also extending its transmission line to Knightsville. George E. Haage is assistant to general manager.

MORRISVILLE, VT.—Bids will be received by the Water and Light Commissioners until April 17 for construction of dam, forebay, penstock lines and power plant for the village of Morrisville. McIntosh & Crandall, Burlington, Vt., are engineers.

BOSTON, MASS.—The City Council is considering the installation of an improved street-lighting system on Essex Street.

LYNN, MASS.—The Lynn Gas & Electric Company contemplates installing a 9,375-kva. steam turbo-generator this year. J. Frank Dubois is superintendent.

NORTH SMITHFIELD, R. I. — The Branch River Wool Combing Company, recently organized, will soon begin work on the power house at its proposed local mill, to cost about $1,000,000. Lockwood, Greene & Company, 24 Federal Street, Boston, are architects and engineers. North Smithfield has not a post office.

Middle Atlantic States

ALBANY, N. Y.—The installation of an ornamental lighting system on Pearl Street from Clinton Avenue to the south city line is under consideration by the Pearl Street Improvement Association.

BUFFALO, N. Y.—The installation of an ornamental lighting system on Erie Avenue from Fourth to Tenth Street is under consideration.

MIDDLETOWN, N. Y.—The installation of an ornamental lighting system in the business district is under consideration.

NEW YORK, N. Y.—Improvements to cost about $15,000,000 and which will be completed by 1925 have been announced by the Long Island Railroad Company. The largest single item is the electrification of the Montauk division from Jamaica to Babylon, at a cost of $4,000,000; the freight line from Bay Ridge, Brooklyn, to Fresh Pond will also be equipped for electrical operation.

PORT HENRY, N. Y.—The Port Henry Light, Heat & Power Company plans to complete the dam and power house at Moriah Center early this summer.

SCHENECTADY, N. Y.—The installation of a uniform system of ornamental street lighting throughout the city has been authorized by the City Council. The lamps will be installed by the General Electric Company.

SCHENECTADY, N. Y.—A contract has been signed between the New State Gas & Electric Corporation and the Adirondack Power & Light Corporation whereby the former will purchase electricity from the latter for a period of ten years. The first work in connection with this contract, it is stated, will be the erection of a transmission line from the property of the Adirondack Power & Light Corporation at Beardsley Falls, on East Canada Creek, in Herkimer County, south to the Herkimer County line to be built by the Adirondack corporation, where it will connect with the line to be erected by the New York State corporation south to Colliers. The line will carry a maximum of 114,000 volts with a maximum capacity of 15,000 kw. The plans call for a substation at Colliers to be erected by the New York State corporation, where the energy from the high-voltage line will be stepped down to 44,000 volts for connection with the present system of the New York State corporation and its subsidiaries. The cost of the substation, including the line to Colliers, is estimated at $500,000. The plans also include the connecting up of all the utility properties acquired in Delaware, Madison, Sullivan and Otsego Counties. The initial expenditure for this purpose is estimated at $750,000.

CEDAR GROVE, N. J.—Bids will be received by George C. Bergen, County Purchasing Agent, Court House, Newark, until May 1, for electrical work in connection with extensions at the local county hospital, underground subway, underground cable, power wiring, etc. Fred S. Sutton, 402 Broad Street, Newark, is architect.

BERRYSBURG, PA.—The Middleburg Light, Heat & Power Company is negotiating for the purchase of the property of the Berrysburg Electric Service Company. It also plans to take over the system at Mifflin and will merge the lines. Extensions in transmission lines will be made in these districts.

BRADFORD, PA.—The Bradford Electric Company contemplates the erection of a steel tower three-phase, 33,000-volt transmission line from Olean, N. Y., to Bradford this year. L. O. Langworthy is superintendent.

NEWPORT, PA.—The Watts Water & Power Company has been granted permission to construct a hydro-electric plant on the Juniata River, to cost about $500,000, with transmission lines.

PHILADELPHIA, PA.—Electric power equipment will be installed at the proposed grain elevator to be built by the Philadelphia & Reading Railroad Company, in connection with its new pier at Port Richmond, to cost $3,500,000. Frederick Jasperson is company engineer.

PITTSBURGH, PA. — The West Penn Power Company has applied for permission to construct transmission lines over the Allegheny River, near Garrett's Run, consisting of nine 25,000-volt lines, three 6,900-volt lines and four telephone wires.

TATAMY, PA. — The Tatamy Light, Heat & Power Company has under consideration the installation of a 2,000-kva. electric generating plant. A. C. Messinger is manager.

BLUEFIELD, W. VA.—The Appalachian Power Company is planning to build the last unit (20,000 kw.) at its local power plant. Viele, Blackwell & Buck, 49 Wall Street, New York City, are engineers.

SHAWSVILLE, VA. — The Shawsville Light & Power Company, recently organized, plans to furnish electrical service here. Contracts, it is understood, have been awarded for plant and equipment. G. W. Gradner is president.

WASHINGTON, D. C.—Bids will be received by the general purchasing officer, Panama Canal, until April 18, for five electric motors, 2,500 ft. telephone cable, 1,500 ft. power cable, 205,000 ft. rubber-insulated wire, 500 lb. magnet wire, 190 lightning arresters, etc. (Circular 1600.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until April 22 for 3,500 pairs searchlight carbons for the San Diego (Cal.) navy yard, 4,000 pairs searchlight carbons for the Mare Island (Cal.) yard, 1,400 fuse elements, 3,000 inclosed fuses, 2,500 inclosed fuses, 3,000 link fuses, 3,500 midget fuses, 300 bracket and ceiling fixture globes and 2,500 flanged heel-globes, all for the Puget Sound yard. (Schedule 2045.)

North Central States

ALGER, MICH. — The Village Council has awarded a contract to C. W. Coppersmith, Lafayette, to furnish electricity in Alger for a period of ten years. Work will soon begin on the construction of the system.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 17 for furnishing and erecting one electric passenger push-button-control elevator in the old main building, city hospital, Cleveland.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 18 for structural steel work for the division of light and power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 25 for one 15,000-kw. steam turbo-generator for the division of light and power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 25 for condensers and condenser auxiliaries for a 15,000-kw. steam turbo-generator for the division of light and power.

LORAIN, OHIO.—Work, it is understood, will soon start on the substation to be erected in Lorain by the Ohio Public Service Company, Cleveland, to cost about $250,000.

MIDDLEPORT, OHIO.—The Ohio River Railway Company, recently organized, has applied for permission to take over and consolidate the Ohio River Electric Railway Company and the Pomeroy & Middleport Electric Company. Line extensions are contemplated.

NEW RICHMOND, OHIO.—The Southern Ohio Power Company, Floodwood, is negotiating for the purchase of the local electric plant, and will merge it with its system. Transmission-line extensions are planned.

TIFFIN, OHIO.—Plans have been approved for an ornamental lighting system in the business district. It will be installed by the Ohio Power Company, which furnishes local service.

CANNELTON, IND.—The installation of a new 150-kva. generating unit in the municipal plant and the erection of about a mile of distribution line is under consideration by the Department of Public Service. Eugene F. Cummings is general manager.

HUNTINGBURG, IND. — Improvements contemplated to the municipal light and water plant include the installation of a new steam ash blower and repairs to all lines. Leo F. Grewe is superintendent.

INDIANAPOLIS, IND. — The Cumberland Hydro-Electric Power Company, Fletcher Building, Indianapolis, recently organized, it is reported, has been granted a preliminary permit from the Federal Power Commission for the construction of three dams on the Cumberland River, two to be located between Burnside and Williamsburg, Ky., and the third in south fork of Cumberland River, near Burnside.

KNIGHTSTOWN, IND.—The installation of a 250-hp. water-tube boiler in the municipal electric plant this year is contemplated. E. M. Sherburne is superintendent.

LAKETON, IND.—Plans are under way by the Northern Indiana Power Company, Kokomo, for extension of its transmission line from Wabash through Urbana to Laketon to supply electrical service here. The plans include a substation in Laketon.

LINNGROVE, IND. — The Marion & Bluffton Traction Company has been granted permission to acquire the property of the Linngrove Light & Power Company. Extension of lines and the installation of substation and other equipment are contemplated.

MISHAWAKA, IND.—Extensions to the distribution lines of the municipal electric light system are under consideration. A. R. Klein is superintendent of the municipal water and electric plant.

PERU, IND.—The installation of coal-handling equipment in the municipal electric and water plant this year is under consideration. B. H. Freeland is manager.

ROCKPORT, IND.—The Rockport Pottery Company, recently organized, contemplates the construction of a power house at its local plant, to cost about $75,000.

ROCKVILLE, IND.—The town officials are considering the question of purchasing energy to operate the municipal electric system from the Wabash Valley Electric Company, Port Clinton, 8 miles distant. Don T. McMillin is superintendeent.

CHICAGO, ILL. — Extensions and improvements contemplated by the Commonwealth Edison Company during 1924 include an increase of 110,000 kw. in its generating station capacity, 122,400 kw. in substation capacity and the construction of the following transmission lines: 778,566 ft. 500,000-circ.mil, three-conductor, 12,000-volt, 60-cycle; 83,000 ft. 350,000-circ.mil, three-conductor. 33,000-volt, 60-cycle; 20,000 ft. 350,000-circ.mil, three-conductor, 22,000-volt, 60-cycle; and also distribution lines as follows: 440,000 ft. No. 0 four-conductor; 110,000 ft. No. 6 four-conductor, and direct-current, 623,000 ft. one-conductor.

METROPOLIS, ILL.—Bids will be received by A. N. Starkes, Mayor, until April 24 for construction of waterworks system and improvements to electric light plant. The work will consist of power station, coal bunker and coal dump, concrete chimney, two boilers, each of 300 hp. capacity; coal elevator and conveyor, engine, generator and switchboard, boiler-feed pumps, four motor-driven centrifugal pumps, etc. The W. A. Fuller Company, Railway Exchange Building, St. Louis, is engineer.

PRINCETON, ILL.—The installation of a 300-hp. or 400-hp. water-tube boiler in the municipal electric plant is under consideration. W. N. Remsburg is superintendent of water and light plant.

AMERY, WIS.—Extensions and improvements contemplated by the Wisconsin Hydro-Electric Company this year include 9 miles of three-phase, 25,000-volt transmission lines and 16 miles of 6,600-volt or 4,000-volt, three-phase line, and also a hydro-electric plant. W. R. Haney is superintendent.

MILWAUKEE, WIS.—Steps have been taken by the Fond du Lac Business Men's Association for the installation of ornamental lamps on several blocks on that thoroughfare, also the installation of electrically operated traffic signal equipment.

PLAINFIELD, WIS.—The local electric plant has been acquired by the Wisconsin Power, Light & Heat Company, Madison, which plans to erect a transmission line from Wautoma to Plainfield and on to Almond, at a cost of about $60,000.

PLATTEVILLE, WIS. — Bonds to the amount of $10,000 for the installation of an ornamental lighting system in the downtown section of the city have been approved by the voters.

GLENCOE, MINN. — Preliminary plans are being prepared by R. W. Richardson, Zenth Building, St. Paul, engineer, for a municipal electric lighting system, to cost about $100,000.

CEDAR RAPIDS, IOWA.—Contracts for the installation of ornamental lamps in three sections are to be awarded by the City Council.

CLARINDA, IOWA.—Work will soon be started on the erection of a 33,000-volt transmission line from Clarinda to Maryville, Mo., a distance of 40 miles, by the Lee Electric Company and the Maryville Electric Light & Power Company. This will give a tie-in between these companies, which are subsidiaries of the Continental Gas & Electric Corporation. Additions will be built to the substations at Clarinda and Maryville to care for the new line, and substations will also be installed at Braddyville, Iowa, and Burlington Junction, Mo. With the completion of the new line, the old 13,200-volt lines which now cover part of the distance will be abandoned.

EDDYVILLE, IOWA.—The installation of a new boiler, about 150 hp., in the municipal electric plant is under consideration. C. E. Chord is superintendent.

LINEVILLE, IOWA. — The Lineville Electric Company is considering selling its steam equipment, which is a complete plant, and purchasing another oil-engine-driven unit. G. W. Molleston is secretary.

STUART, IOWA.—Changing the system of the municipal electric plant from direct to alternating current and the installation of oil engines is under consideration. F. C. Knoll is superintendent of the municipal light and water plant.

ST. LOUIS, MO.—Bids will be received by the Commissioner of Indian Affairs, United States Indian Warehouse, until May 29, for a quantity of electrical supplies.

JAMESTOWN, N. D.—The local plant of the Western Electric Company has been acquired by the Ottertail Power Company, Fergus Falls, Minn. The new owners, it is reported, plan to erect transmission lines south from Jamestown to serve many towns.

RAVENNA, NEB.—The Central Power Company, Grand Island, has acquired the local plant of the Ravenna Electric Light, Heat & Power Company. Plans are under way for rebuilding, the system, to cost about $25,000.

RISING CITY, NEB.—The Blue River Power Company, Seward, is negotiating for the purchase of the municipal electric plant and plans to extend its transmission line here.

SEWARD, NEB.—At special elections held recently in the town Filley, Crab Orchard, Lewiston and Virginia the proposal to issue bonds for the erection of a transmission line from Adams to Lewiston and an electric distribution system in each town was carried. The service will be furnished by the Blue River Power Company of Seward.

TOPEKA, KAN. — The Kansas Public Service Company, recently formed, has taken over the Topeka Railway & Light Company, Topeka Edison Company, Topeka Railway Company, Atchison Railway, Light & Power Company and the Wichita Railway & Light Company. Extensions and improvements to cost about $500,000, it is said, are contemplated.

Southern States

FARMVILLE, N. C.—Bids will be received by the Mayor and Commissioners of the town of Farmville until April 29 for extensions and improvements to the municipal electric light plant, including addition to power house, concrete spray pond, etc.; furnishing one 250-kw. uniflow-engine-driven generating unit, generator and two feeder panels, surface condenser, vacuum and circulating pump, etc. William C. Olsen, Raleigh, is consulting engineer.

WHITAKERS, N. C. — Bonds to the amount of $10,000 have been issued, the proceeds to be used for extensions and improvements in the municipal electric plant.

PARIS ISLAND, S. C.—Bids will be received by the quartermaster's department, marine barracks, until April 18 for 2,000 ft. lamp cord, 5,000 ft. copper wire, 10,000 ft. telephone wire, 3,000 ft. rigid conduit, etc.

MIAMI BEACH, FLA.—The American Light & Power Company contemplates extensions to the system of the Miami Beach Electric Company, recently acquired, to cost about $700,000, including the installation of a 5,000-kw. turbo-generator.

COLUMBIA, TENN. — Preparations are being made by the Southern Cities Power Company, Chattanooga, for the reconstruction of the dam across Duck River, which will increase the capacity of the local plant by 1,000 hp. The company has applied to the City Council for a franchise to erect a local distribution system and to supply electricity in Columbia.

DRESDEN, TENN.—The Kentucky-Tennessee Light & Power Company, Guthrie, Ky., contemplates extending its high-tension lines from Maysfield to a number of towns in this section to supply electrical service. It is proposed to double the line back to the Tennessee River and on back to Hopkinsville, Ky.

LAFAYETTE, LA.—At an election held recently the proposal to issue bonds for improvements to the municipal electric and water plant was carried.

LAKE CHARLES, LA.—The Lake Charles Rice Milling Company, it is reported, plans to rebuild its plant and power house, recently damaged by fire with a loss of about $500,000.

CROCKETT, TEX.—The Texas Power & Light Company has acquired the system of the Crockett Light & Ice Company, and plans to extend its transmission line here. Improvements will be made in the local system.

Pacific and Mountain States

ABERDEEN, WASH.—Plans, it is said, are well under way, by the Grays Harbor Railway & Light Company for the installation of additional equipment in its steam-power plant at Electric Park, extension to its substation No. 3 at Hoquiam and the rebuilding of its distribution system serving the entire Grays Harbor district, changing the voltage from 2,300 to 4,000.

KELSO, WASH.—Plans are being prepared for the installation of a new street lighting system, to cost about $60,000.

PORT ORCHARD, WASH.—A franchise has been granted to the North Pacific Public Service Company, Bremerton, for the erection of transmission lines and to ex-

tend its electric service around the head of the bay to Port Orchard and south Kitsap County.

TACOMA, WASH.—The City Council is considering the installation of ornamental lamps on North Fifth Street from Sixth Avenue to North Twenty-first Street.

BARTLE, CAL.—The Mount Shasta Silica Company, Weed, plans to build a power house at its proposed local plant, to cost about $150,000.

CORONA, CAL.—The City Council has authorized the installation of ornamental lamps on important streets, using "Marbelite" standards.

LOS ANGELES, CAL.—The Municipal Power Bureau has filed application with the State Water Commission for permission to use water from Rock Creek for a hydroelectric power development, to cost about $400,000.

OAKLAND, CAL.—The Pacific Gas & Electric Company has filed plans for the erection of a substation on North Twentieth Street, near Telegraph Avenue, to cost $60,000.

POTRERO, CAL.—The Pacific Gas & Electric Company plans to build an addition to its local steam-operated electric power plant, and also improvements in the transmission and distributing lines.

REDONDO, CAL.—Plans are being prepared by Victor Stahell, city engineer, for the installation of a new street-lighting system, to include all principal streets of the city. The cost is estimated at about $100,000.

TURLOCK, CAL.—Bids will be received at the office of the Trulock Irrigation District, Turlock until April 18 for electrical equipment, including one 3,000-kw. generator, one 400-kw. transformer, one 3,300-kw. vertical turbine wheel, one 1,000-kw. horizontal turbine wheel, switchboard and equipment and two penstocks.

VALLEJO, CAL.—The Vallejo Electric Light & Power Company contemplates the installation of some electrollers this year. Albert Casper is general manager.

WILLITS, CAL.—The Central Mendocino County Power Company contemplates extension of its service lines, covering about 3 miles, and the installation of an air compressor plant for the Northwestern Pacific Railroad. Edward Morris is manager.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association is installing a 7,500-kva. generator at the Roosevelt power plant, to be in operation about July 1. H. J. Lawson is superintendent of power.

AGUILAR, COL.—The Aguilar Light & Power Company contemplates the extension of a number of rural lines during 1924 and is also considering the installation of an ornamental lighting system, consisting of forty lamp standards, carrying 250-cp. units. William M. Letcher is manager.

GOLDEN, COL.—The Jefferson County Power & Light Company plans to erect 6 miles of transmission lines and 4 miles of distribution lines this year. E. A. Phinney is president and manager.

HOTCHKISS, COL.—The Hotchkiss Electric Company contemplates connecting the town with a plant at a coal mine by a 15-mile, 13,200-volt transmission line this year. C. S. Shyrock is manager.

PAGOSA SPRINGS, COL.—The New Light & Power Company contemplates the installation of a new street-lighting system, consisting of seven ornamental standards mounted with 200-watt lamps, and fifty-three bracket fixtures mounted with 100-watt lamps. J. L. Giger is manager.

Canada

VANCOUVER, B. C.—Preliminary steps have been taken by the Chamber of Commerce looking toward the installation of a cluster-lamp system in the business section of the city.

ST. JOHN, N. B.—Announcement has been made in the State Legislature that the government proposes to develop the water power at Grand Falls on the St. John River.

VERDUN, QUE.—Plans are being considered by the City Council for extensions to the municipal electric plant to cost about $40,000.

Miscellaneous

KEKAHA, ISLAND OF MAUI, HAWAII —The Hawaii Commercial & Sugar Company plans to construct a 5,000-kw. hydroelectric power plant for mill service for which orders for equipment will soon be placed.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 18, 1924)

1,487,275. ELECTROMETALLURGY; C. A. Scharschu, Pittsfield, Mass. App. filed Dec. 27, 1920. Method of and apparatus for refining steel and other metals and particularly silicon steel.

1,487,286. INDUCTION DYNAMO-ELECTRIC MACHINE; H. W. Taylor, Rugby, England. App. filed Feb. 15, 1922. Secondary windings arranged to have different resistance effects at line and slip frequencies.

1,487,294. DISTRIBUTION SYSTEM; H. Trencham, Ruislip, England. App. filed Aug. 23, 1921. Method of protecting distribution systems against faults.

1,487,298. METHOD OF AND APPARATUS FOR VIBRATION; H. J. Vennes, New York, N. Y. App. filed Sept. 5, 1919. For subjecting various devices to vibration tests.

1,487,301. SIGNALING SYSTEM; W. C. White, Schenectady, N. Y. App. filed Jan. 31, 1919. For transmitting wireless signals.

1,487,308. RADIO RECEIVING SYSTEM; H. H. Beverage, Riverhead, N. Y. App. filed Jan. 20, 1921.

1,487,309. AIRPLANE SIGNALING APPARATUS; W. T. Booth, East Orange, N. J. App. filed April 25, 1919. Combined interphone and radio-telephone sets.

1,487,311. CURRENT COLLECTOR FOR ELECTRIC VEHICLES; G. W. Bower, Schenectady, N. Y. App. filed Nov. 18, 1921. For trackless trolley systems.

1,487,339. RADIO SIGNALING SYSTEM; E. W. Kellogg, Schenectady, N. Y. App. filed Jan. 20, 1921. Improved arrangement of antenna for receiving purposes.

1,487,342. ELECTRIC GENERATING APPARATUS; J. O. W. Lavallee, Montreal, Quebec, Canada. App. filed Oct. 31, 1921. Small electric generator plants for domestic or farm use.

1,487,351. HEADPIECE FOR TELEPHONES; A. Montan, West Orange, N. J. App. filed May 27, 1922. Adjustable.

1,487,353. ELECTRON-DISCHARGE APPARATUS; H. J. Nolte, Schenectady, N. Y. App. filed Sept. 8, 1921. Means for evolving one of the electrodes.

1,487,361. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; L. Polinkowsky, New York, N. Y. App. filed Feb. 24, 1919. Of the full automatic type.

1,487,369. PANELBOARD; G. W. Berthold, Chicago, Ill. App. filed Jan. 2, 1917. "Dead-front" type.

1,487,409. STATION INDICATOR; J. W. Wallin, Beloit, Wis. App. filed July 11, 1923. Of the double reel and web type.

1,487,422. MOTOR CONTROLLER; C. W. Yerger, Milwaukee, Wis. App. filed June 23, 1919. Multiple-switch type.

1,487,428, 1,487,429, 1,487,430. BATTERY; W. Balderston, Madison, Wis. App. filed Aug. 10, 1921. Plural-cell dry type with special container.

1,487,435. CONTROL DEVICE FOR ELECTRICALLY DRIVEN LIFTS, CRANES, WINCHES AND LIKE APPARATUS FOR DEALING WITH VARIABLE LOADS; V. Breeze, Brighton, England. App. filed Aug. 24, 1920. Automatically insuring high speeds of running on light loads.

1,487,457. MOUNTING FOR PANELBOARDS, ETC.; F. E. Hafemeister, Cleveland, Ohio. App. filed July 14, 1919. Making it possible to adjust the board with the box or frame in the wall.

1,487,476. ELECTRIC POCKET AND NIGHT LAMP; P. Rombach, Karlsruhe, Germany. App. filed April 19, 1922. Having means for enabling the lamp bulb to be depressed into the casing.

1,487,492. REGULATING SYSTEM; L. W. Thompson, Schenectady, N. Y. App. filed May 28, 1923. For speed or voltage regulation.

1,487,494. BATTERY; D. W. Tyrrell, Madison, Wis. App. filed Jan. 3, 1921. Dry cells permanently housed together in a common container.

1,487,502. MAGNETO FLASHLAMP; J. J. Wood, Fort Wayne, Ind. App. filed May 4, 1922.

1,487,504. REGULATING SYSTEM; H. S. Baker, Niagara Falls, Ontario, Canada. App. filed April 19, 1921. Regulators of the vibratory-contact type are employed to effect the desired regulation of voltage.

1,487,516. PRODUCTION METER; H. H. Heller, New York, N. Y. App. filed Feb. 5, 1921. Recording the successive amounts of work performed by a machine in successive time intervals.

1,487,544. TRANSFORMER FOR RADIO RECEIVING SETS; R. M. Dinsmore, Little Falls, N. J. App. filed Nov. 20, 1922. Air-core type.

1,487,549. LIGHTING SYSTEM; S. W. Everett, Topeka, Kan. App. filed Jan. 5, 1906. Comprising a variable-speed generator, a storage battery charged thereby and lamps operated by either the generator or the storage battery.

1,487,614. REACTANCE COIL; E. G. Sohlberg, Schenectady, N. Y. App. filed Feb. 26, 1923. So influenced by changes in current strength as automatically to vary its own reactance.

1,487,615. ALTERNATING-CURRENT POTENTIOMETER; B. W. St. Clair and S. C. Hoare, Lynn, Mass. App. filed Oct. 18, 1922. For measuring the number of turns in a coiled wire.

1,487,617. ELECTRICAL APPARATUS; D. C. Stoppenbach, New York, N. Y. App. filed Aug. 17, 1920. Electrostatic condenser; means for holding the sheets together.

1,487,620. WIRE TERMINAL; G. B. Thomas, Bridgeport, Conn. App. filed Dec. 17, 1920. for rotary snap switches, etc.

1,487,657. GAS-FILLED ELECTRIC LAMP; E. J. Hunt, Newark, N. J. App. filed July 10, 1920.

1,487,680. SYSTEM OF CONTROL; L. J. Hibbard, Wilkinsburg, Pa. App. filed Dec. 17, 1919. For effecting proper sequential operation of a plurality of switching devices for governing the motoring and the regenerating operations of a set of single-phase commutator motors.

1,487,682. ELECTRIC CIRCUIT TERMINAL; H. E. Leppert, New Britain, Conn. App. filed July 3, 1922. For electric switches.

1,487,691. TELEGRAPH SYNCHRONIZING SYSTEM; D. Murray, London, England. App. filed Feb. 15, 1924. For multiplex printing-telegraph systems.

1,487,693. ELECTRIC SYSTEM FOR GENERATING UNITS; C. P. Brockway, Toledo, Ohio. App. filed April 28, 1919. Using gas-engine-driven generator and floating battery.

1,487,697. CONTROLLER FOR ELECTRIC MOTORS; H. P. Reed, Milwaukee, Wis App. filed April 10, 1922. Of two-speed alternating-current type having separate slow-speed and high-speed primary windings and a squirrel-cage secondary.

(Issued March 25, 1924)

1,487,728. DRY CELL; H. de Olaneta, New Haven, Conn. App. filed March 24, 1920. Of pocket type with improved form of gas chamber.

1,487,758. PORTABLE ELECTRIC LIGHT; E. Rabideau, Bay City, Mich. App. filed Feb. 23, 1923.

1,487,761. TELEPHONE SYSTEM; C. Sparks, Oak Park, Ill. App. filed June 29, 1918. Using link or cord circuits in completing connections between subscribers' lines.

1,487,766. PROTECTIVE DEVICE FOR VENTILATING FANS; A. G. Sutcliffe, Chicago, Ill. App. filed Nov. 13, 1919. Providing automatic cooling of the motor and using fresh air from outside of the room being ventilated.

1,487,771. TIRE-INFLATION TESTING APPLIANCE; I. A. Weaver, Springfield, Ill. App. filed March 1, 1920. By automatically measuring the length of the flat contact of the tire with the ground and sounding an alarm.

1,487,837. THERAPEUTIC APPARATUS; G. Bueckle, Brooklyn, N. Y. App. filed Dec. 14, 1920. Control of bathing apparatus where an electric current flows through a liquid in a tub.

1,487,852. SPARK INDICATOR AND INTENSIFIER FOR GASOLINE ENGINES; H. Hanaeur, Tolland, Mass. App. filed Dec. 12, 1922.

1,487,870. AUTOMATIC TELEPHONE EXCHANGE; F. A. Lundquist, Chicago, Ill. App. filed Oct. 27, 1919.

1,487,888. MEASURED-SERVICE TELEPHONE SYSTEM; R. G. Richardson, Chicago, Ill. App. filed Nov. 15, 1919. For automatic party-line systems.

1,487,898. SMOKE INDICATING AND RECORDING DEVICE; R. C. Stolp, Chicago, Ill. App. filed June 13, 1921. Using an element that exhibits a variation in conductivity under the action of light which is passed through the smoke.

1,487,913. PHONOGRAPH MOTOR; P. P. Belt, Fredonia, Kan. App. filed June 10, 1921.

1,487,937. EXTENSION CORD; L. A. Griffin, Evanston, Ill. App. filed Dec. 10, 1921. With waterproof covering around wires at socket.

1,487,954. BINDING POST; A. Kleinhesselink, Grange City, Iowa. App. filed March 13, 1923.

1,487,983. PORTABLE ELECTRIC FLASHLAMP; J. Stiriss, Arverne, N. Y. App. filed Oct. 5, 1922. With new-type switch.

1,487,996. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Dec. 28, 1920. Automatic system of relay type.